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Areawide Waste Treatment and Water Quality Management Planning. Appendix B-2 Pollution Sources: Agriculture

Greater Egypt Regional Planning and Development Commission, Carbondale, IL

Prepared for

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Areawide Waste Treatment and Water Quality Management Planning

Pollution Sources: Agriculture

Appendix B-2

Franklin, Gallatin, Hamilton, Hardin, Jackson, Jefferson, Perry, Pope, Saline, and Williamson Counties, Illinois

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GREATER EGYPT REGIONAL PLANNING & DEVELOPMENT COMMISSION

Areawide Waste Treatment and Water Quality Management Planning

Pollution Sources: Agriculture

Appendix B-2

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Franklin, Gallatin, Hamilton, Hardin, Jackson, Jefferson, Perry, Pope, Saline, and Williamson Counties, Illinois

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The Pollution Sources: Agriculture report is Appendix B-2 of the Areawide Waste Treatment and Water Quality Management Plan for Southern Illinois. The report was prepared under Section 208 of the Water Pollution Control Act, as amended. It addresses the problems of agriculture as a water pollution source in Southern Illinois, and makes recommendations to be implemented to address those problems. Erosion as it contributes to sedimentation and herbicide and pesticide contamination is addressed, as well as livestock and feedlot operations.

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November 1978

Michael P. Mauzy
Acting Director
Illinois Environmental Protection Agency
2200 Churchill Road
Springfield, Illinois 62706

Dear Mr. Mauzy:

The Commission is pleased to transmit Appendix B-2, Pollution Sources: Agriculture of the 208 Areawide Waste Treatment and Water Quality Management Plan for Southern Illinois. The plan and this document cover the ten Illinois Counties of Franklin, Gallatin, Hamilton, Hardin, Jackson, Jefferson, Perry, Pope, Saline, and Williamson.

This technical report is an integral part of the Southern Illinois Water Quality Management Plan that is designated to meet the contract requirements of Federal Grant Number P005225-01 under the U. S. Water Pollution Control Act Amendments of 1972, as administered by the United States Environmental Protection Agency.

We trust this submittal of this report, as well as the others comprising the plan, will provide the basis for certification of the plan and continued designation of this area.

Sincerely,

A. S. Kirkikis

A. S. Kirkikis
Executive Director

ASK:db

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United States Environmental Protection Agency

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Franklin County Soil and Water Conservation District
Gallatin County Soil and Water Conservation District
Hamilton County Soil and Water Conservation District
Jackson County Soil and Water Conservation District
Jefferson County Soil and Water Conservation District
Perry County Soil and Water Conservation District
Pope-Hardin County Soil and Water Conservation District
Saline County Soil and Water Conservation District
Williamson County Soil and Water Conservation District

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Chapter 1

INTRODUCTION

The Water Pollution Control Act Amendments of 1972, Public Law 92-500, provided numerous mechanisms to states, regions, and municipalities to address problems related to water quality. Section 208 of the Act provided for the designation of areawide agencies to address water quality management problems.

The Greater Egypt Regional Planning and Development Commission (GERP&DC), in conjunction with the Southeastern Illinois Regional Planning and Development Commission (SIRP&DC), and supported financially by the Illinois Environmental Protection Agency (IEPA), prepared a report identifying basic complex water quality management problems within the ten-county area consisting of Franklin, Gallatin, Hamilton, Hardin, Jackson, Jefferson, Perry, Pope, Saline, and Williamson Counties, Illinois. Based upon this study, the support of the local governments, and the results of a public hearing, the Governor of Illinois, in April 1975, designated the ten Counties as a 208 planning area. Greater Egypt Regional Planning and Development Commission was designated as the lead 208 agency responsible for undertaking the development of required water quality management planning; and Southeastern Illinois Regional Planning and Development Commission was delegated to assist with 208 planning in the five eastern counties of the 208 planning area.

This report is a part of the continuing planning process for water quality management and concerns water pollution that may result from agricultural activities within the ten-county 208 area. Non-point sources of pollution in the areas of erosion, fertilizer usage, pesticide usage, and livestock wastes will be examined. Recommendations from the area Land Use and Agriculture Committee of methods to limit or eliminate pollution from these non-point sources will presented for each subject area.

Importance of Agricultural Production

A broad range of agricultural products are raised in Illinois. This broad range is reflected in the varied agricultural activities taking place within the 208 area. The following table indicates the extent and varied nature of these activities.

Table 1
CROP AND PASTURE ACREAGE IN THE 208 AREA

	Acres	% of Farmland
Corn	230,477	13.81
Soybeans	440,267	26.38
Wheat	140,304	8.41
All Hay	87,601	5.25
Oats	3,248	.19
Other Crops	25,346	1.52
Total Crops Harvested	927,243	55.56
All Other Pastured	268,707	16.10
All Other Land	473,163	28.34
Total Other Farm Land	741,870	44.44
Total Harvested and Other Farm Land	1,669,113	100.00

Source: Illinois Cooperative Crop Reporting Service, Illinois Agricultural Statistics, 1974.

Farm land of 1,669,113 acres represents over 61% of the region's total land area of 2,731,340 acres. Therefore, even small amounts of pollutants per acre may reach significant levels when considered on an areawide basis.

The following provides information on the presence of livestock on farms within the ten-county 208 area for 1973.

Table 2
NUMBER OF LIVESTOCK REPORTED:
By Farm and Type, 1973

	Farms Reporting	Number
Hens and Pullets	627	72,943
Grain Fed Cattle and Calves Marketed	1,251	25,768
Other Cattle and Calves Marketed	2,036	32,265
Hogs and Pigs Marketed	1,847	260,571
Breeding Ewes	94	2,307

Source: Illinois Cooperative Crop Reporting Service, Illinois Agricultural Statistics, 1974.

General Nature of Agriculture Water Pollution

Agricultural water pollution is the movement of soils, chemicals, and animal wastes from farm land into waterways. Pollutants enter surface and ground waters from sources which are usually non-specific. These sources are often difficult to identify. The four major categories of agricultural pollutants are: (1) erosion/sedimentation; (2) nutrient/fertilizer; (3) pesticides (which includes herbicides); and (4) feedlot/livestock wastes. Soil disturbing (agricultural) endeavors are a potential source of pollution. However, when care is taken and proper management practices are followed agricultural activities can occur with little or no detrimental effect on water quality.

The major pollutant in terms of volume is sediment. Erosion and sedimentation are naturally and continually occurring geological processes. The factors which determine the extent to which erosion will take place include rainfall, soil type, slope, land use, and conservation practices utilized. These factors are all part of the Universal Soil Loss Equation.* Some of the activities of the modern agricultural production process can greatly accelerate the erosion process, but conservation practices can be utilized to reduce the impact of agriculture on erosion. Excessive amounts of sediment can obstruct drainage, fill reservoirs, make streams turbid, and act as a transportation means for other agricultural pollutants.

*See Chapter 2 for a discussion of the Universal Soil Loss Equation.

The use of chemical fertilizers to supplement the nutrients of the soil is regarded by the agricultural community as necessary in most soils to optimize crop yields and plant quality. Fertilizers can also reduce erosion by increasing plant cover. However, fertilizers containing nitrogen (N), phosphorus (P), and potassium (K) are now used in sufficient quantities to make the chemical pollution of water a concern. High concentrations of nitrate/nitrogen in drinking water may be toxic to animals and humans. High concentrations in waterways increases the growth of algae, which causes an oxygen deficiency in the water, making the water unable to support fish and animal life.

Pesticides, which include insecticides, miticides and herbicides, are applied to soil and crops to limit or prevent parasitic organism damage to farm crops. Certain pesticides such as DDT and mercury have received widespread publicity of their harmful effects to aquatic life and humans. Pesticide contamination of waterways may be caused by overuse of the chemicals near lakes or streams, by poor policies and practices in treatment or application of the chemicals, or by excessive soil erosion. It should be noted that many agricultural chemicals are not acutely toxic to animal life, do not persist from one crop season to the next, and do not accumulate in food chain organisms. They may therefore be used at normal application rates with little likelihood of unacceptable environmental damage occurring.

Water pollution may result from animal wastes from either a feedlot or pasture setting. Feedlots represent the operation of greatest concern because the higher density of the animal population produces large amounts of wastes within a small area. Animal wastes accumulate at a far greater rate than the soil's ability to absorb and assimilate it safely. Improper waste handling can result in runoff of sufficiently high levels of pollutants (primarily nitrogen and fecal coliforms) into streams to contaminate water supplies and destroy aquatic life. Water pollution from livestock feedlots almost always originates from one of three sources: (1) the feedlot facility itself, where manure is produced; (2) manure storage or treatment components; (3) and the disposal of the wastes (usually done by applying it to land as fertilizer).

At the conclusion of each of the following four chapters are recommendations of the 208 Land Use and Agriculture Committee of Best Management Practices (BMP) which would limit or eliminate pollution from these sources. In most instances the BMP's originated from subcommittees of the state Task Force on Agriculture Non-Point Sources of Pollution. The BMP's adopted by the Subcommittees on Soil Erosion, Livestock Waste,

Pesticide, Fertilizer, Forestry, and Fruit Production were reviewed by the 208 Land Use and Agriculture Committee and those BMP's deemed applicable and appropriate for the ten-county 208 area were adopted for inclusion in this report.

The Best Management Practices listed in the report are important steps for the elimination and prevention of water pollution from agricultural activities. Implementation of these practices for most facilities within the 208 area will be the responsibility of individual farm operators. Efforts must be made to ensure that these operators are aware of and understand the techniques described, the importance of their use, and the potential environmental consequences if these techniques are not utilized.

Chapter 2

SOIL EROSION

The movement of soils into surface waters is the primary source of agricultural water pollution within the ten-county 208 area. This movement of soils in the erosion process is a means of transportation for the soil and for significant amounts of other agricultural pollutants.

The factors which contribute to the erosion process are numerous and varied. These factors include rainfall, soil type, slope, land use, conservation practices, as well as natural erosion and sedimentation. Acts of man, however, can greatly accelerate the erosion process. Conversely, conservation practices can be employed to reduce the impact of agriculture on the erosion process.

Erosive actions carry away plant residues, soil and associated plant nutrients, and pesticides. Sheet, rill, or gully erosion occurs when increasing amounts of water collect and move across the surface of the soil. Erosive actions decrease the productive capacity of the land through the following:

1. Loss of valuable topsoil which contains organic matter and available plant nutrients;

2. Changes in the soil structure which reduces the water retention capacity of the soil;

3. Reduction of the infiltration of water; and

4. Increases the rate of water runoff.

Downstream effects of erosion may include excessive quantities of sediment that:

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1. Obstruct drainage;
2. Fill reservoirs;
3. Make streams turbid; and
4. Transport plant and soil associated pollutants.

Erosion Costs in the 208 Area

An attempt was made to assemble data which would illustrate some of the costs of erosion and sedimentation in the ten-county 208 area of Southern Illinois. The data illustrated should be helpful to Soil and Water Conservation District personnel and to others in explaining economic effects of erosion to land-users.

The information is based upon research by the Agricultural Research Services, the Conservation Needs Inventory, and interpretations by S.C.S. personnel. Information included in the following tables is intended to represent averages for the area and may not be applied to a specific set of conditions. The Universal Soil Loss Equation should be used for individual sites.

In the first of the two following tables, the amounts of nutrients lost, land damage, increased farming costs, and sediment damage by ton of eroded topsoil are illustrated. The second of the two tables illustrates the effects of increased row crop production on erosion. This information illustrates the problems of erosion in row crop production.

Table 3
AVERAGE COST OF EROSION IN THE 208 AREA

	Cost/Ton of Eroded Topsoil
Loss of Nutrients*	$5.88
Damage to physical quality of soil	.40
Increased cost of farming	.10
On Site Total	$6.38
Sediment (Assume 50% leaves site as sediment)	
Removal of sediment	$1.25
Spreading and Disposal	.50
Off Site Total	$1.75
Total Cost Per Ton	$8.13

*Nutrients includes nitrogen, phosphorus, and potassium

Source: Unpublished Data
U.S. Department of Agriculture
Soil Conservation Service.

Table 4
AREAWIDE
CROPLAND CHANGE, TOTAL EROSION
AND COST OF EROSION, 1967-1975

	Cropland Acreage Change 1967-1975	Total Erosion (tons)		Cost of Erosion (dollars)	
		1967	1975	1967	1975
Franklin	-7,600	1,101,000	1,059,000	6,882,000	6,577,000
Gallatin	15,000	413,000	656,000	2,352,000	4,290,000
Hamilton	N.A.	N.A.	902,000	N.A.	2,261,361
Hardin-Pope	-3,200	749,000	739,000	2,591,000	2,461,000
Jackson	35,300	1,157,000	1,410,000	5,778,000	8,624,000
Jefferson	22,900	1,606,000	1,791,000	10,258,000	11,993,000
Perry	-59,100	996,000	1,044,000	5,960,000	4,326,000
Pope	(Included with Hardin)				
Saline	-10,800	666,000	675,000	3,441,000	3,172,000
Williamson	-2,100	867,000	865,000	3,927,000	3,826,000

Source: Unpublished Data
U.S. Department of Agriculture
Soil Conservation Service

Cropland acreage changes have occurred in each of the counties in the area. Gallatin, Jackson, and Jefferson Counties experienced sizable increases in cropland acreage during the period 1967-1975. Gallatin County shows an increase of 29,400 acres, Jackson increased by 35,300 acres, and Jefferson shows an increase in cropland of 22,900 acres during the period. Other counties such as Perry, Saline, and Williamson may have shown increases if the coal strip mining activities in these counties had not absorbed crop and pasture lands. Hardin and Pope Counties together decreased in cropland during the 1967-1975 period by 3,200 acres.

Based upon the data presented, it appears that almost all of the counties in the 208 area have increased in total erosion from 1967 to 1975. Exceptions to the increase in erosion are Hardin and Pope (counted together), Franklin and Williamson County. Counties which have increased in tons of total erosion are generally those which have increased in cropland. This is to be expected, because non-point pollution from erosion and sedimentation is usually much more prevalent on lands which have been cropped than on those lands idle or used for pasture.

Counties which show dramatic increases of erosion during the 1967-1975 period are Gallatin, Jackson, Jefferson, Perry, and Saline. Gallatin County increased from 413,000 tons to 656,000 tons of soil eroded during the 8 year period; Jackson County erosion increased from 1,157,000 tons to 1,410,000 tons; Jefferson County increased from 1,606,000 tons to 1,791,000 tons; and Saline County increased from 666,000 tons to 675,000 tons during the same period.

Costs of cropland erosion are generally proportionate to the total erosion, except in Perry and Saline Counties. The reason for this exception is that their major erosion problems may derive from causes other than agriculture, i.e., strip mining.

The counties which show the greatest annual losses from cropland erosion in 1975, compared with 1967, are Gallatin, Jackson, and Jefferson. The annual cost of erosion increased in Gallatin County from $2,352,000 in 1967 to $4,290,000 in 1975; Jackson County increased from $5,788,000 to $8,624,000; and Jefferson County increased from $10,258,000 to $11,993,000 during the same period. The losses from cropland erosion in almost all of the remaining counties of the 208 area had decreased slightly during

this same period. These decreases were not always due to improved control practices, but in some instances caused by decreased cropping, because of land absorbed by strip mining activities or recently constructed reservoirs.

Universal Soil Loss Equation

The Universal Soil Loss Equation is a primary tool in estimating erosion of specific land areas. The equation takes into account the major factors determining the soil loss that will occur as a result of erosion. The basis equation can be expressed as:

$$A = R\ K\ L\ S\ C\ P$$

where:

A is the computed soil loss per year per unit area of land expressed in tons per acre.

R is the average annual rainfall erosion index or the average annual force of rainfall.

K is the soil erodibility factor. It is a measure of the rate at which a soil will erode expressed as tons per acre per year per unit of R for a 9 percent slope 72.6 feet long under continuous cultivated farrow. (Soil loss tolerance (T) is not found in the equation, but is important to the use of the equation in practical field application. It is the maximum soil loss in tons per acre per year which can be tolerated on a specific soil and still permit a high level of crop production to be sustained economically and indefinitely.)

L is the slope length factor. It is the ratio of soil loss from a specified slope length to that from a slope length of 72.6 feet long, which is the slope length for the K value in the equation. A slope length of 72.6 feet long has a factor value of 1.L is determined in the field.

S is the slope gradient factor. It is the ratio of soil loss from a specific slope gradient to that from a gradient of 9 percent, which is the slope gradient specified for the K value in the soil loss equation. A slope gradient of 9 percent has a factor value of 1.S as determined in the field. L and S are usually handled in combination. The soil loss ratio--SL, can be read directly from the slope-effect chart.

C is the cropping management factor. It is the ratio of soil loss from land cropped under specified conditions to the corresponding loss from the land in continuous fallow. Continuous fallow has a factor value of 1 in the equation.

P is the conservation practice factor. It is the ratio of soil loss from a specified conservation practice to that from up-and-down hill tillage operations. Up-and-down hill tillage has a factor value of 1 in the equation.

Although the equation accounts for the factors of rainfall, soil erodibility, slope, crop management, and conservation practices, it does not provide for detailed analysis of the interrelationships between these factors.

Soil Erodibility as a Factor in Soil Erosion

The soil erodibility factor is expressed in the Universal Soil Loss Equation as the letter K. Soil types vary in their susceptibility to erosion.

Many different soil types exist in the ten counties of the 208 area. These soils, when grouped together because of similar characteristics produced sixty-nine soils associations. Twenty-seven of these associations are relatively common throughout the ten-county region, while the other forty-two associations are unique to localized areas within the region. The following are descriptions of ten major soil associations found in the ten-county 208 area.

(1) Bluford-Wynoose-Cisne association: These soil areas consist mainly of nearly level or gently sloping, somewhat poorly or poorly drained soils on broad flats, knolls, or sideslopes along drainageways of uplands. These soils primarily formed in loess. Minor soils include Hoyleton and the better drained Ava.

These soils generally have a silt loam surface layer and heavy, silty clay loam or silty clay subsoil. Water moves slowly or very slowly through the soil. Surface runoff is slow to medium, but the soil in depressional areas is subject to ponding. The seasonal water table is commonly near the surface. Water available for plant growth is moderate or high. These soils generally have a good potential for row crops,

small grain, meadow or for woodland. Wetness abatement for control of erosion on more sloping soil is commonly needed in use.

(2) Hurst-Okaw-McGary association: These soil areas consist mainly of nearly level to sloping, somewhat poorly or poorly drained soils on broad flats, ridges, or sideslopes of terraces. These soils have primarily formed in clayey and silty water-laid sediments. Minor soils include the better drained Colp and St. Charles.

These soils generally have a silt loam surface layer and silty clay or heavy silty clay loam subsoil. Water moves slowly or very slowly through the soil. Surface runoff is generally slow or medium. Low-lying soil is commonly subject to occasional flooding. The seasonal water table is commonly near the surface, but is deeper on more sloping soil. Water available for plant growth is moderate or high. These soils generally have a fair to good potential for row crops, small grain, meadow or for woodland. Wetness abatement or control of erosion on more sloping soil is often needed in use.

(3) Reesville-Uniontown association: These soil areas consist mainly of gently sloping or sloping, somewhat poorly or moderately well-drained soils on broad to narrow ridges and sideslopes of terraces. These soils have primarily formed in silty or loamy water-laid sediments. Minor soils include Weinbach and the poorly drained Patton and Ginat.

These soils generally have a silt loam or loam surface layer and silty clay loam or clay loam subsoil. Water moves moderately to slowly through the soil. Surface runoff is generally slow or medium but ranges to rapid on more sloping soil. Low-lying soil is commonly subject to occasional flooding. The seasonal water table is mainly several to many feet deep. Water available for plant growth is high or moderate. These soils generally have a good potential for row crops, small grain, meadow or for woodland. Control of erosion is often needed on more sloping soil.

(4) Alvin-Camden association: These soil areas consist mainly of gently to strongly sloping, well or moderately well drained soils on broad to narrow ridges and sideslopes of terraces. These soils have primarily formed in sandy or loamy water-laid sediments. Minor soils include the more poorly drained Roby.

These soils generally have a fine sandy loam surface layer and fine sandy loam or clay loam subsoil. Water moves moderately to moderately

rapid through the soil. Surface runoff is generally slow to medium. The seasonal water table is mainly several to many feet deep. Water available for plant growth is generally moderate but ranges low. These soils generally have a fair potential for row crops, small grain, meadow or for woodland, but potential for some speciality crops is good. Control of erosion, either from surface runoff or from wind, is often needed.

(5) Ava-Hickory-Blair association: These soil areas consist mainly of gently to strongly sloping, moderately well and somewhat poorly drained soils on ridgetops, sideslopes and hillsides of the uplands. These soils have primarily formed in loess or glacial drift. Minor soils include Bluford with a more clayey subsoil and Belknap in small bottomlands.

These soils mainly have a silt loam or loam surface layer and a silty clay loam or clay loam subsoil. Generally, the lower subsoil is compact, a fragipan. The more sloping soil is eroded in most places. Water moves slowly or very slowly through the fragipan, but moderately through the soil without a pan. Surface runoff is medium to rapid. Water available for plant growth is moderate in most places.

The broader, less sloping soils have a fair to good potential for most uses. The more sloping soil generally has a good to fair potential for meadow, woodland or wildlife. Severely eroded soil, particularly on south-facing slopes tends to be droughty. Control of erosion is commonly needed in use.

(6) Hosmer-Zanesville-Wellston association: These soil areas consist mainly of sloping to steep, moderately well-drained and well drained soils on ridgetops, sideslopes or hillsides of the upland. These soils primarily formed in loess or material weathered from bedrock. Minor soils include Grantsburg, the more stony Berks and Burnside or Sharon in small bottomlands.

These soils mainly have a silt loam surface layer and silty clay loam or loam subsoil, but in some places the subsoil is clayey. Generally, the lower subsoil is compact, a fragipan, and also on steeper slopes part of the subsoil is channery or gravelly. Except where wooded, the soil on most sideslopes or hillsides is eroded. Water moves slowly or very slowly in the fragipan, but moderately or moderately rapid through soil without a pan. Surface runoff is medium to very rapid. Water available for plant growth is moderate or low.

These soils generally have a fair to good potential for meadow, woodland or wildlife. Less sloping soil on broader ridgetops has fair to good potential for row crops or small grain. Severely eroded soil, particularly that on south-facing slopes is droughty. Erosion, steepness of slopes, and stoniness in some places are concerns in use.

(7) Alford-Wellston association: These soil areas consist mainly of sloping to steep, well drained soils on ridgetops, sideslopes or hillsides of the upland. These soils primarily formed in loess or material weathered from bedrock. Minor soils include Grantsburg and Bedford which have a fragipan, Baxter a cherty subsoil, and Haymond in small bottomlands.

These soils mainly have a silt loam surface layer and silty clay loam subsoil, but the subsoil is clayey in some places. On steeper slopes, part of the subsoil is channery. In a few places, the lower subsoil is compact, a fragipan. Except where wooded, the soil on most sideslopes and hillsides is eroded. Water moves moderately or moderately rapid through the soil, but only slowly where there is a fragipan. Surface runoff is medium to very rapid. Water available for plant growth is high to low, depending upon the amount of coarse fragments.

These soils generally have a good to fair potential for meadow, woodland or wildlife. Less sloping soil on the broader ridgetops has a good to fair potential for row crops or small grain. Erosion, steepness of slopes, and stoniness in some places are concerns in use.

(8) Belknap-Bonnie-Piopolis association: These soil areas consist mainly of nearly level or gently sloping, somewhat poorly or poorly drained soils in bottomlands. These soils primarily formed in silty sediments. Minor soils include the better drained Medway and Armiesburg and the more clayey Karnak.

These soils generally have silt loam or silty clay loam layers, but include silty clay. In some places, the underlying layer is loamy or sandy. Water moves slowly to moderately through most of the soils. Surface runoff is slow to ponded. Unless protected, the soil is commonly subject to flooding. Except for more sloping or undulating soil, the seasonal water table is near the surface. Water available for plant growth is high in most places. These soils, where drained and protected, have a good potential for row crops, and in most places, the potential for woodland is good. Drainage and protection from flooding or overflow are concerns in use.

(9) Darwin-Jacob association: These soil areas consist mainly of nearly level, poorly drained soils in bottomlands. These soils primarily formed in clayey sediments. Minor soils include Cairo and Medway soils which are underlain with loamy sediments.

These soils generally have silty clay or clay layers. Water moves very slowly through the soil. Surface runoff is ponded to slow. Unless protected, the soil is commonly subject to flooding or ponding of backwaters. The seasonal water table is at or near the surface. Water available for plant growth is generally moderate. These soils, where drained and protected, have a fair potential for row crops.

(10) Orthent association: These soil areas consist mainly of sloping to steep ridges, sideslopes, and depressions of spoil banks. Ridges have been struck-off and spoil banks partially levelled in some places. Soils are primarily in loamy material that is generally stone. Slurry pits and ponds or lakes are included.

These soils generally have a stony orchannery loam, clay loam, or silty clay layers. Water moves moderately rapid to moderately slowly through the soil. Surface runoff is generally medium to very rapid, but is ponded in the depressions or troughs. Water available for plant growth is moderate or low. These soils generally have fair potential for meadow, woodland, or wildlife.

In the following narrative and illustrations, the properties and water management capabilities of the soils in the 208 planning area are identified and described. Soil survey interpretations are provided for each of the 208 area soils, and a summary is given for each soil association as well as each group of soil associations. The soil interpretations have been provided by the United States Department of Agriculture - Soil Conservation Service.

Uniformity in terminology and criteria used in rating each of the various soil types is important to the effectiveness of the interpretation. Two common interpretations used by the Soil Conservation Service are "soil suitability ratings" and "soil limitation ratings". For the purposes of the 208 program, soil limitation ratings are used for certain specific uses of the soil. In this regard, the ratings are often defined as slight, moderate, or severe. More extensive definitions are as follows:

- Slight (limitation) - Soil which has properties favorable for the rated use. Soil limitations are minor and can be easily overcome.

- Moderate (limitations) - Soils which have properties moderately rated for the rated use. The limitations usually can be overcome or modified with good planning and design.

- Severe (limitations) - Soils which have one or more unfavorable soil properties for the rated use. A very severe rating indicates the unfavorable properties are very expensive to overcome.

Soil Data Accuracy Constraints

Some constraints must be understood about the accuracy of soil limitation ratings. These are as follows:

- Soil data usually applies to the upper 5 or 6 feet of soil material, or to an indicated shallower depth.

- Interpretations are based upon prediction of soil behavior under defined conditions.

- Soil ratings are based upon the natural (undisturbed) soil for practically all uses.

- Criteria for making interpretations are based upon the current state of the science.

- Severe, or very severe, ratings do not imply that the site cannot be changed in order to change, correct, or modify the soil limitations.

- Soil interpretations do not eliminate the need for on-site evaluation by qualified professionals.

Sequential Explanation of Soil Interpretations Used in this 208 Agriculture Study

1. Estimated soil properties:

   - Permeability - Values listed are estimates of the range in rate and time it takes for downward movement of water in the major soil layers when saturated, but allowed to drain fully. The estimates are based on soil texture, soil structure, available data on permeability and infiltration tests, and observation of water movement through soils.

- Soil Reaction - Soil reaction or the intensity of soil acidity or alkalinity is expressed in pH. A pH of 7 is neutral. Lower values indicate acidity and higher values show alkalinity.

- Shrink-Swell Potential - Indicates the volume changes to be expected for the specific soil material with changes in moisture content.

- Erosion T Factor - Soil loss tolerance factor based on the average annual soil loss in tons per acre that can be tolerated and still maintain economic production.

- Wind Erodibility Group - A grouping of surface soil textures into eight categories based on susceptibility of wind erosion. Group 1 is most susceptible to wind erosion and group 8 is most resistant.

2. Community Development:

- Shallow Excavations - Excavating or trenching to depths of 5 or 6 feet for dwellings, sewers, utilities, etc. Limitations depend upon drainage, water table depth, flooding, depth to bedrock, slope and stoniness.

3. Water Management:

- Embankments, Dikes, and Levees - The factors considered here are those properties and qualities of disturbed soils that affect their suitability for construction pond embankments, dikes, and levees. Soil features that affect construction area: stability, compaction characteristics, resistance to piping, shrink-swell potential, compressibility, and permeability when compacted.

- Drainage - The features which affect drainage of cropland and pastureland include permeability, depth of restrictive layers, water table depth, flooding, and availability of suitable outlets.

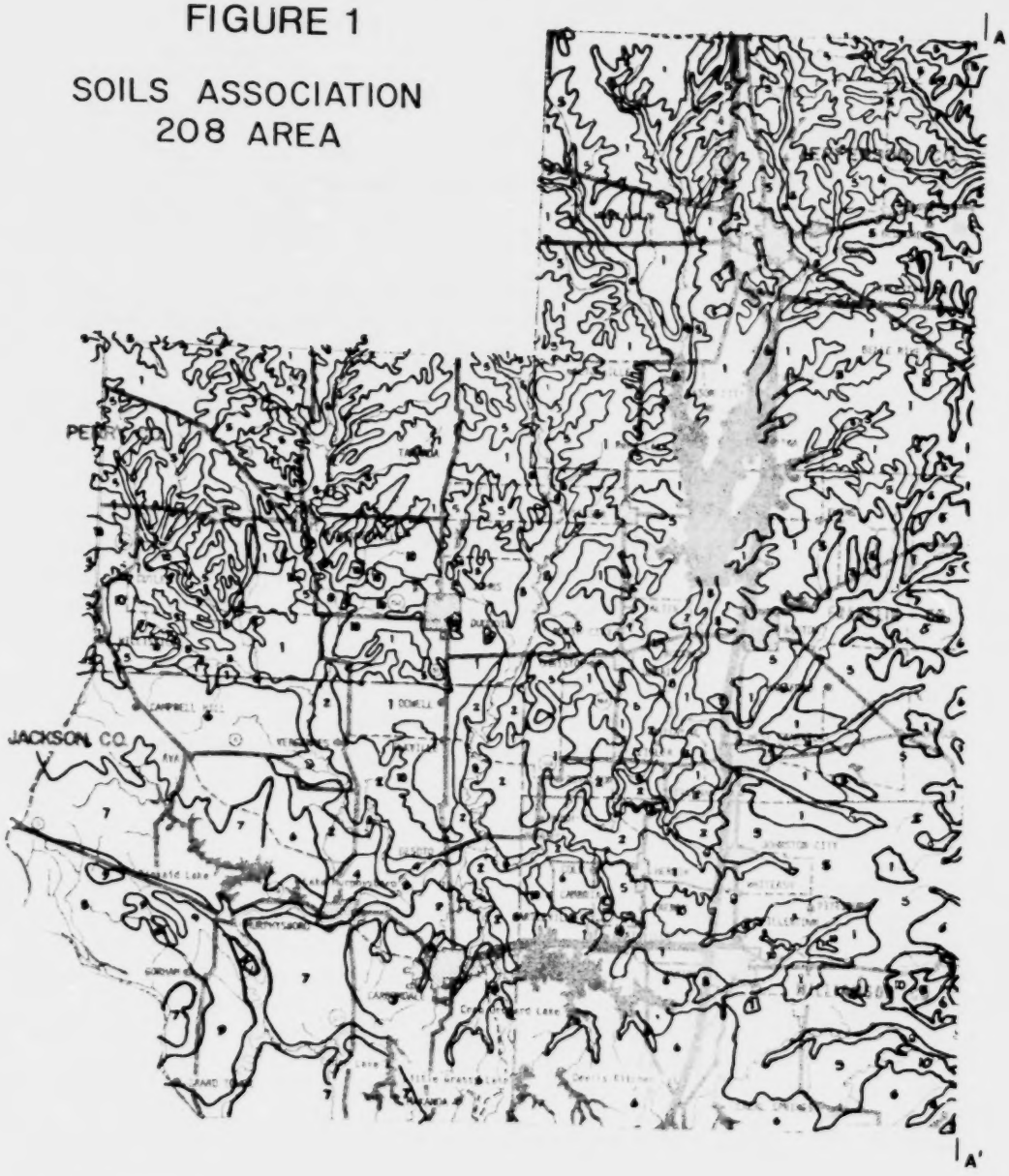
- Irrigation - Soil features considered are those that affect the design and suitability of supplemental irrigation. These include slope, rate of water intake, need for drainage, soil depth, stoniness, and erosion hazards.

- Terraces and Diversions - Soil factors considered in the use of soils for terraces and diversions are: percent, length, and shape of slope; texture and permeability; presence of stones and erosion hazards.

- Grassed Waterways - The factors considered in the evaluation are stability of soil material, texture and depth of soil material, natural drainage, presence of stones, percent of slope, and difficulty of establishing and maintaining vegetation.

FIGURE 1

SOILS ASSOCIATION 208 AREA



1 BLUFORD-WYNOOSE-CISNE ASSOCIATION
2 HURST-OKAW-MCGARY ASSOCIATION
3 REESVILLE-UNIONTOWN ASSOCIATION
4 ALVIN-CAMDEN ASSOCIATION
5 AVA-HICKORY-BLAIR SOILS
6 HOSMER-ZANESVILLE-WELLSTON ASSOC.
7 ALFORD-WELLSTON ASSOCIATION
8 BELNAP-BONNIE-PIOPOLIS ASSOCIATION
9 DARWIN-JACOB ASSOCIATION
10 ORTHENT ASSOCIATION

MARCH 1978

DRAWN BY: P.CASSIDY, J. KENT

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GREATER EGYPT REGIONAL PLANNING & DEVELOPMENT COMMISSION

FIGURE 1
SOILS ASSOCIATION
208 AREA

1 BLUFORD-WYNOOSE-CISNE ASSOCIATION
2 HURST-OKAW-MCGARY ASSOCIATION
3 REESVILLE-UNIONTOWN ASSOCIATION
4 ALVIN-CAMDEN ASSOCIATION
5 AVA-HICKORY-BLAIR SOILS
6 HOSMER-ZANESVILLE-WELLSTON ASSOC.
7 ALFORD-WELLSTON ASSOCIATION
8 BELNAP-BONNIE-PIOPOLIS ASSOCIATION
9 DARWIN-JACOB ASSOCIATION
0 ORTHENT ASSOCIATION

MARCH 1978

DRAWN BY: P.CASSIDY, J.KENT

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GREATER EGYPT REGIONAL PLANNING & DEVELOPMENT COMMISSION

The following three tables deal with soils in the 208 area. Table 5 illustrates 208 area soils and soil properties, Table 6 shows soils and their water management capabilities; and Table 7 illustrates the development potential for each soil type.

Table 5
MAJOR SOILS AND SOIL PROPERTIES
IN THE 10 COUNTY 208 AREA

Name of Soil		Estimated Soil Properties						
						Erosion		
Name of Soil	208 Soil Area #	At Depth of ___ (in.)	Permeability (in./hr.)	Soil Reaction (pH)	Shrink-Swell Potential	Factors T	Wind Grp.	Flooding Frequency
Alford	6,7	0-13	0.6-2.0	5.1-7.3	Low	5-4	5	None
Allison	8	0-17	0.6-2.0	6.6-7.8	Moderate	5	7	Frequent
Alvin	4	0-18	2.0-6.0	5.1-6.5	Low	5-4	3	None
Armiesburg	8	0-14	0.6-2.0	6.1-7.3	Moderate	5	6	Frequent
Ava	5	0-9	0.2-0.8	3.6-5.5	Moderate	4-3	6	None
Baxter	6,7	0-16	0.6-2.0	3.6-6.0	Low	4-3	-	None
Beaucoup	9	0-15	0.6-2.0	6.1-7.8	Moderate	5	7	Frequent
Bedford	6,7	0-15	0.6-2.0	3.6-6.0	Low	4-3	5	None
Belknap	5.8	0-13	0.2-0.6	4.5-6.0	Low	5	5	Common
Blair	5	0-5	0.6-2.0	5.6-6.0	Low	3-2	6	None
Bluford	1,5	0-16	0.2-0.6	4.5-5.5	Moderate	3-2	6	None
Bonnie	8	0-8	0.6-2.0	6.6-7.3	Low	5	6	Frequent
Becker		0-19	0.08	5.6-7.3	Very High	5	4	Common
Camden	4	0-13	0.6-2.0	5.1-6.0	Low	5-4	6	None-Occasional
Cape	8	0-22	0.06-0.2	4.5-7.3	Moderate	3	6	Frequent
Cisne	1	0-19	0.06-0.6	5.1-6.0	Moderate	3	6	None
Colp	2	0-11	0.2-0.6	3.6-5.5	Moderate	3-2	6	None
Darwin	9	0-56	0.06	6.1-7.8	Very High	5	4	Frequent
Emma	2,8	0-8	0.6-2.0	4.5-6.1	Moderate	5-4	6	Rare
Ginat	3	0-9	0.6-2.0	4.5-7.3	Low	4	5	None
Grantsburg	6	0-24	0.6-2.0	5.1-6.0	Low	4-3	6	None
Hickory	5	0-16	0.6-2.0	4.5-6.0	Low	5-4	6	None
Hosmer	6	0-10	0.6-2.0	4.5-6.0	Low	4-3	5	None
Hoyleton	1	0-12	0.6-2.0	4.5-5.5	Moderate	3-2	6	None
Hurst	2	0-10	0.2-0.6	4.5-5.5	Moderate	3-2	6	Rare
Jacob	9	0-4	.06-0.2	5.1-6.5	Very High	3	8	Frequent
Karnak	8	0-5	.06-0.2	5.6-6.3	High	3	4	Frequent
Markland	2	0-7	0.6-2.0	5.6-7.3	Low	3-2	5	None
Medway	9	0-15	0.6-2.0	6.1-8.4	Low	5	6	Common
Montgomery	2	0-11	0.2-0.6	6.1-6.5	High	5	4	None
Okaw	2	0-15	0.2-0.6	4.5-6.5	Low-Mod.	3-2	6	Occasional
Patton	2,3	0-15	0.6-2.0	6.6-7.3	Moderate	5	7	Rare
Piopclis	8	0-7	.06-0.2	5.1-5.5	Moderate	4	7	Frequent
Reesville	3	0-12	.6-2.0	6.1-6.6	Low	5	-	None
Roby	4	0-7	0.6-2.0	4.5-6.0	Low	4	3	None

Table 5
(Continued)

Name of Soil	208 Soil Area #	Estimated Soil Properties: At Depth of ___ (in.)	Permeability (in./hr.)	Soil Reaction (pH)	Shrink-Swell Potential	Erosion Factors T	Erosion Wind Grp.	Flooding Frequency
Ruark	4	0-18	0.6-2.0	4.5-6.0	Low	4	3	Occasional
Sciotoville	3	0-8	0.6-2.0	5.1-6.5	Low	4-3	-	Rare
Sexton	2	0-18	0.2-0.6	5.6-6.5	Low	4	6	Rare
Sharon	8	0-40	0.6-2.0	4.5-5.5	Low	5	5	Frequent
Shiloh	9	0-17	0.2-0.6	6.1-7.3	High	3	4	Frequent
Stoy	6	0-13	0.2-0.6	5.1-6.0	Low	4-3	6	None
Uniontown	3	0-9	0.6-2.0	5.1-7.3	Low	4-3	-	None
Wabash	9	0-6	.06-0.2	5.6-7.3	High	5	4	Common
Wagner	2	0-15	0.2-0.6	6.1-7.8	Low	3	6	Occasional
Wakeland	8	0-8	0.6-2.0	6.6-7.3	Low	5	5	Frequent
Wellston	6,7	0-7	0.6-2.0	5.1-6.5	Low	4-3	-	None
Wynoose	1	0-18	0.2-0.6	3.6-5.5	Moderate	3	6	None
Zanesville	6	0-7	0.6-2.0	4.5-5.5	Low	3-2	-	None

Source: GERP&DC Staff based on Soil Conservation Service Data.

Table 6
MAJOR SOILS AND WATER MANAGEMENT
CAPABILITIES IN THE 10 COUNTY 208 AREA

Name of Soil	208 Soil Area #	Water Management				
		Embankments Dikes & Levees	Drainage	Irrigation	Terraces & Diversions	Grassed Waterways
Alford	6,7	Erodes Easily	Not Needed	Erodes Easily	Erodes Easily	Erodes Easily
Allison	8	Favorable	Not Needed	Floods	Not Needed	Not Needed
Alvin	4	Seepage	Not Needed	Favorable	Favorable	Favorable
Armiesburg	8	Shrink-Swell	Not Needed	Freq: Floods Prot: Favorable	Not Needed	Not Needed
Ava	5	Low Strength	Not Needed	Slow Intake	Erodes Easily	Erodes Easily
Baxter	6,7	Low Strength Hard to Pack	Not Needed	Slope, Erodes Easily	Slope, Erodes Easily	Slope, Erodes Easily
Beaucoup	9	Shrink-Swell	Floods	Wetness, Floods	Wetness	Wetness
Bedford	6,7	Compressible, Erodes Easily	Not Needed	Erodes Easily, Slow Intake	Erodes Easily, Percs. Slowly	Erodes Easily, Wetness
Belknap	5,8	Hard to Pack	Floods	Wet, Slow Intake	Not Needed	Erodes Easily
Blair	5	Low Strength	Percs. Slowly, Wetness	Erodes Easily, Slow Intake	Percs. Slowly	Erodes Easily
Bluford	1,5	Low Strength	Percs. Slowly	Slow Intake, Wetness	Percs. Slowly	Favorable
Bonnie	8	Low Strength	Floods, Wetness	Slow Intake, Wetness	Not Needed	Not Needed
Becker		Shrink Swell, Low Strength	Floods, Wetness	Slow Intake, Wetness	Percs. Slow, Wetness	Percs. Slow, Wetness
Camden	4	Favorable	Not Needed	Erodes Easily	Slope, Erodes Easily	Favorable

Table 6
(Continued)

Name of Soil	208 Soil Area #	Water Management				
		Embankments Dikes & Levees	Drainage	Irrigation	Terraces & Diversions	Grassed Waterways
Cape	8	Compress-ible, Low Strength	Floods, Wetness	Slow Intake, Wetness	Not Needed	Not Needed
Cisne	1	Shrink, swell, Low Strength	Percs. Slowly	Wetness, Slow Intake	Not Needed	Not Needed
Colp	2	Low Strength	Percs. Slowly	Slow Intake	Erodes Easily, Percs. Slowly	Erodes Easily
Darwin	9	Hard to Pack, Shrink Swell	Percs. Slowly, Floods	Wetness, Slow Intake	Not Needed	Not Needed
Emma	2,8	Low Strength	Not Needed	Slow Intake	Erodes Easily, Percs. Slowly	Erodes Easily
Ginat	3	Low Strength, Erodes Easily	Percs. Slowly, Wet, Slow Intake	Percs. Slowly, Wetness	Not Needed	Not Needed
Grantsburg	6	Low Strength	Percs. Slowly	Rooting Depth, Slow Intake	Percs. Slowly	Erodes Easily
Hickory	5	Low Strength, Shrink Swell	Not Needed	Slope	Slope, Erodes Easily	Slope, Erodes Easily
Hosmer	6	Low Strength, Erodes Easily	Not Needed	Percs. Slow, Erodes Easily	Percs. Slowly, Erodes Easily	Percs. Slowly, Erodes Easily
Hoyleton	1	Low Strength	Persc. Slowly, Wetness	Slow Intake	Persc. Slowly, Erodes Easily	Wetness
Hurst	2	Hard to Pack Low Strength	Percs. Slowly	Slow Intake, Wetness	Percs. Slowly	Percs. Slowly

Table 6
(Continued)

Name of Soil	208 Soil Area #	Water Management				
		Embankments Dikes & Levees	Drainage	Irrigation	Terraces & Diversions	Grassed Waterways
Jacob	9	Low Strength, Shrink-Swell	Percs. Slowly	Wetness, Slow Intake	Not Needed	Not Needed
Karnak	8	Compress-ible, Low Strength	Poor Outlets, Percs. Slowly	Percs. Slowly, Slow Intake	Not Needed	Not Needed
Markland	2	Low Strength, Compress-ible	Not Needed	Erodes Easily, Slow Intake	Complex Slope, Erodes Easily	Slope, Percs., Erodes Easily
Medway	9	Piping	Floods, Poor Outlets	Floods, Wetness	Not Needed	Favorable
Montgomery	2	Compress-ible, Shrink-Swell	Percs. Slowly, Wetness	Slow Intake, Wetness	Not Needed	Not Needed
Okaw	2	Low Strength, Shrink-Swell	Floods, Percs., Poor Outlets	Slow Intake, Floods, Wet	Percs. Slowly, Wetness	Percs. Slowly, Wetness
Patton	2,3	Shrink-Swell, Low Strength	Wetness	Wetness	Not Needed	Not Needed
Piopclis	8	Low Strength	Floods, Wetness	Wetness, Slow Intake	Not Needed	Not Needed
Reesville	3	Piping, Unstable Fill	Favorable	Wet, Percs. Slowly	Wet	Wet
Roby	4	Piping	Favorable	Favorable	Favorable	Favorable
Ruark	4	Piping	Wetness	Wetness	Not Needed	Not Needed
Sciotoville	3	Low Strength, Piping	Percs. Slowly	Rooting Depth, Erodes Easily	Percs. Slowly, Piping	Percs. Slowly, Erodes Easily

Table 6
(Continued)

Name of Soil	208 Soil Area #	Water Management				
		Embankments Dikes & Levees	Drainage	Irrigation	Terraces & Diversions	Grassed Waterways
Sexton	2	Low Strength	Percs. Slowly	Wetness, Slow Intake	Not Needed	Not Needed
Sharon	8	Piping, Low Strength	Floods	Favorable	Not Needed	Not Needed
Shiloh	9	Shrink-Swell	Favorable	Percs. Slowly, Floods	Not Needed	Not Needed
Stoy	6	Low Strength	Percs. Slowly	Wetness, Slow Intake	Percs. Slowly	Favorable
Uniontown	3	Low Strength, Hard to Pack	Not Needed	Erodes Easily	Erodes Easily, Slope	Erodes Easily, Slope
Wabash	9	Compress-ible, Low Strength	Floods, Wet, Percs. Slowly	Slow Intake, Wet, Floods	Percs. Slowly, Wet	Percs. Slowly, Wet
Wagner	2	Shrink-Swell	Floods, Percs. Slowly	Wetness, Slow Intake	Percs. Slowly, Wetness	Wetness
Wakeland	8	Piping, Low Strength	Frost Action, Floods, Wet	Wet, Floods	Not Needed	Not Needed
Wellston	6,7	Hard to Pack, Erodes Easily	Not Needed	Erodes Easily, Slope	Erodes Easily, Slope	Erodes Easily, Slope
Wynoose	1	Low Strength	Percs. Slow, Wetness	Wetness, Slow Intake	Not Needed	Not Needed
Zanesville	6	Compress-ible, Hard to Pack	Percs. slow, Wet, Slope	Percs. Slowly, Erodes Easily	Percs. Slowly, Erodes Easily	Percs. Slowly, Erodes Easily

Source: GERP&DC Staff based on Soil Conservation Service Data.

Table 7
MAJOR SOILS AND DEVELOPMENT CAPABILITIES
IN THE 10 COUNTY 208 AREA

Name of Soil	208 Soil Area #	Development Shallow Excavations (% Slope)
Alford	6,7	0-15+ = Slight-Severe
Allison	8	Severe-Floods
Alvin	4	0-15+ = Slight-Severe
Armiesburg	8	Freq: Severe-Floods Protected: Slight
Ava	5	Severe-Percs. Slowly
Baxter	6,7	0-15+ = Mod.-Severe
Beaucoup	9	Severe-Floods
Bedford	6,7	Severe-Percs. Slowly
Belknap	5,8	Severe-Floods
Blair	5	Severe-Percs. Slowly
Bluford	1,5	Severe-Percs. Slowly Wetness
Bonnie	8	Freq: Floods Terrace: Severe Wet
Becker		Common: Floods Protected: Perc. Slow
Camden	4	0-15+ = Slight-Severe
Cape	8	Sev. Wetness, Percs. Slowly
Cisne	1	Severe, Wet, Percs. Slowly
Colp	2	Severe, Percs. Slowly
Darwin	9	Severe-Wetness, To Clayey, Floods
Emma	2,8	Moderate-Wetness, Floods
Ginat	3	Severe-Wetness
Grantsburg	6	Moderate-Wet
Hickory	5	5-15+ = Mod.-Severe Slope
Hosmer	6	0-15+ = Mod.-Severe Slope
Hoyleton	1	Severe Wetness
Hurst	2	Severe-Wetness, Too Clayey
Jacob	9	Severe-Wetness, Floods
Karnak	8	Severe Floods, Too Clayey, Wetness
Markland	2	Severe, Too Clayey
Medway	9	Severe-Floods, Wetness
Montgomery	2	Severe, Wetness
Okaw	2	Severe Wetness, Floods, Too Clayey
Patton	2,3	Severe-Wetness
Piopclis	8	Severe-Wetness, Floods
Reesville	3	All: Severe Wet
Roby	4	Severe Wetness, Cutbanks Cave

Table 7
(Continued)

Name of Soil	208 Soil Area #	Development Shallow Excavations (% Slope)
Ruark	4	Severe-Wetness
Sciotoville	3	0-15%: Severe-Wet
Sexton	2	Severe-Wetness, Perc. Slowly
Sharon	8	Shallow Excavations
Shiloh	9	Severe-Wetness, Too Clayey, Floods
Stoy	6	Severe-Wetness
Uniontown	3	0-15+%: Slight-Severe
Wabash	9	Severe-Wet, Floods, Too Clayey
Wagner	2	Severe-Wetness, Floods
Wakeland	8	Severe-Floods
Wellston	6,7	0-15+%: Mod.-Severe
Wynoose	1	Severe Wetness, Too Clayey
Zanesville	6	0-15+%: Severe Wet & Slope

Source: GERP&DC Staff based on Soil Conservation Service Data.

Slope as Factor in Soil Erosion

Slope of the land is a major factor in determining the amount of erosion which will probably occur. Within the Universal Soil Loss Equation two factors relate to the effect of slope on erosion. S represents the slope gradient factor and L represents the slope length factor. These two factors are usually considered together.

In 1967, a Conservation Needs Inventory (CNI) was conducted by the Soil Conservation Service and other U.S.D.A. agencies. A considerable amount of data was collected and analyzed to determine how much land is adequately treated as well as to identify practices needed on land not adequately treated. Using that data, and making some assumptions and interpretations, the average annual erosion in tons per acre was estimated for sloping cropland in each county of the State of Illinois. Averages for the ten-county 208 area in Southern Illinois may be found in the following table (Table 8). The table also shows the number of acres of sloping cropland at the time of the inventory. Most counties have increased crop acreage since the CNI inventory. Some of the counties have experienced the conversion of large areas to strip mining.

An average of all counties in the 208 area produces slightly over 10.0 tons per acre of erosion of sloping cropland each year. Differences between counties are caused by differences in topography, degree of slope, type of soils, vegetative cover, crop rotation, amount of terracing, and other factors.

The number of acres of sloping cropland varies widely between counties. For example, Jefferson County had 128,700 acres of sloping cropland with an annual average erosion of 10.9 tons per acre. Thus, in Jefferson County more than 1.4 million tons of soil is eroded each year, which produces sedimentation in the streams and lakes of the watersheds that engulf the county. By contrast, Pope and Hardin Counties together had only 34,184 acres of sloping cropland in the 1967 CNI inventory, but their erosion of sloping cropland for these two counties in tons per acre was the same as that for Jefferson County. Therefore, the total tonnage of erosion of sloping cropland for the two counties was approximately 375,000 - considerably less than Jefferson County's total.

The following table shows the erosion of sloping cropland and the number of acres of sloping cropland calculated in the 1967 CNI.

Table 8
AVERAGE ANNUAL WATER EROSION
IN TONS PER ACRE OF SLOPING CROPLAND
IN THE 10 COUNTY 208 AREA

County	Erosion of Sloping Cropland (Tons Per Acre)	1967 CNI (Sloping Cropland Acres)
Franklin	10.0	94,800
Gallatin	9.1	35,600
Hamilton	10.3	NA
Hardin	10.9	*34,184
Jackson	11.1	71,800
Jefferson	10.9	128,700
Perry	10.7	76,800
Pope	9.9	Included w/ Hardin
Saline	10.3	46,100
Williamson	10.9	49.700

Source: Unpublished Data
U.S.D.A. - Soil Conservation Service

* Includes Hardin & Pope Counties

Crop Management as a Factor in Soil Erosion

The crop management factor in the Universal Soil Loss Equation is represented by the letter C. This factor varies both with the type of crop under production and the actual practices utilized in its production.

Crop land in the 208 area is illustrated in two tables which accompany this narrative. One table shows the total number of acres of particular crops harvested, total acres of crops harvested, acres of land pastured, acres of other farm land, and total acreage of farms operated - all for the entire ten-county 208 area. In this table the acreages of crop land and pasture land are provided for the year 1973. Farms operated and total acreage of farms operated is given for 1974. The other table illustrates the same kind of information, but shows the data on an individual county-by-county basis for the same year.

In the table showing areawide totals for the 208 planning area in 1973, a figure of 1,669,113 acres constitutes the total harvested and other farm land in the ten county 208 planning area. Of this total, 55.56% of the land, or 927,243 acres, constitutes the total crops harvested. All land pastured in the 208 area makes up 16.10% of the total acreage of farms operated, or 268,707 acres. All other land included within the total acreage of farms operated in the entire area comes to 28.34% or 473,163 acres.

Of all the crops harvested in the ten-county 208 area during 1973, soybeans utilized the greatest area, with 440,267 acres. This was 26.38% of the total harvested and other farm land. Corn was second (13.81%), followed by wheat (8.41%) and all hay (5.25%).

The two leading counties in number of acres of total crops harvested in the ten-county 208 area during 1973 were Hamilton and Jefferson. Hamilton County had 155,902 acres of total crops harvested (69.79% of its total farm land). Jefferson County ranked closely behind Hamilton in acreage of total crops harvested, with 154,058 acres (59.88% of its total farm land). These two counties were followed by Franklin, Gallatin, Jackson, Saline, and Perry, in that order.

In the category of "all land pastured," Jackson, Pope, and Jefferson Counties had the greatest acreages during 1973. Jackson County's 41,715 acres of land pastured represented 18.41% of the total farm land. Pope County's 37,366 acres in land pastured represents 27.66% of the total farm land in the county; and, Jefferson County had 36,466 acres of land pastured, 14.17% of the total farm land in that county.

The same table described above also illustrates total harvested and other farm land, i.e., total farm land. Jefferson County ranked highest in total farm land, with 257,293 acres in 1973. Jackson County (226,574 acres) and Hamilton County (223,398 acres) ranked second and third in total acres of farm land. Following these counties in total farm acreage were Franklin, Saline, and Gallatin.

In spite of the decreases in acreage of farms operated from 1970-1974, six of the ten counties have experienced increases in acreage of crops harvested. Some of the increases in cropping acreage have been considerable. For example, Franklin County increased in acreage of total crops harvested from 109,848 acres in 1969 to 131,847 acres in 1973. Other counties which had increases in acreage of total crops harvested during the same period are Jackson, Jefferson, Gallatin, Hamilton, and Pope. Pope County experienced the most dramatic change by increasing cropland from 24,159 acres in 1969 to 41,972 acres in 1973.

Counties which decreased in cropping acreage during the five year period are Perry, Williamson, Hardin, and Saline. Three of the four counties may have experienced decreases in cropping because of increased land ownership or productivity by mining operations.

Nine of the ten counties in the 208 planning area have shown decreases in pasture land from 1969 through 1973. While farming activities are guided to a great degree by market prices, the increased cropping does usually cause increased erosion and sedimentation problems. Of the ten counties, Hardin was the only one to experience an increase in pasture land during the five year period. It increased from 15,806 acres of pasture to 21,106 acres. The nine counties which decreased in pasture land demonstrated decreases ranging from 20 to 40%.

Table 9

CROP LAND HARVESTED AND OTHER FARM LAND, BY COUNTY, IN THE 10 COUNTY 208 AREA, 1973

	208 Planning Area Total		Franklin County		Gallatin County		Hamilton County	
	Acres	% of Farmland	Acres	% of all Farmland	Acres	% of all Farmland	Acres	% of all Farmland
Crop Land Harvested:								
Corn	230477	13.81	23208	11.93	41486	25.82	31514	14.11
Soybeans	440267	26.38	73834	37.96	63222	39.36	87569	39.20
Wheat	140304	8.41	24471	12.58	14831	9.23	24707	11.06
All Hay	87601	5.25	6824	3.51	1530	.95	8674	3.88
Oats	3248	.19	217	.11	80	.05	812	.36
Other Crops	25346	1.52	3293	1.69	2220	1.38	2626	01.18
Total Crops Harvested	927243	55.56	131847	67.78	123369	76.79	155902	69.79
Other Farm Land:								
Plowland Pasture-	268707	16.10	21021	10.81	11688	7.28	23186	10.38
All Other Pasture- --All Land Pastured								
All Other Land	473163	28.34	41632	21.41	25586	15.93	44310	19.83
Total Other Farm Land	741870	44.44	62653	32.22	37274	23.21	67496	30.21
Total Harvested & Other Farm Land	1669113	100.00	194500	100.00	160643	100.00	223398	100.00
Farms Operated--- Total Acreage 1974	1660325		192501		159130		222042	
Difference	- 8778		- 1999		- 1513		- 1356	

Table 9 (Cont'd)

	Hardin County		Jackson County		Jefferson County		Perry County	
	Acres	% of all Farmland	Acres	% of all Farmland	Acres	% of all Farmland	Acres	% of all Farmland
Crop Land Harvested:								
Corn	3168	5.40	24789	10.94	33609	13.06	17038	14.07
Soybeans	532	.91	47532	20.98	78289	30.43	30062	24.82
Wheat	0	0	21867	9.65	23455	9.12	12856	10.61
All Hay	6605	11.25	11573	5.11	15116	5.88	12413	10.25
Oats	48	.08	568	.25	491	.19	276	.23
Other Crops	1335	2.27	2866	1.26	3098	1.20	4339	3.59
Total Crops Harvested	11688	19.91	109195	48.19	154058	59.88	76984	63.56
Other Farm Land:								
Plowland Pasture-	21106	35.96	41715	18.41	36466	14.17	18200	15.02
All Other Pasture-- All Land Pastured								
All Other Land	25899	44.13	75664	33.40	66769	25.95	25949	21.42
Total Other Farm Land	47005	80.09	117379	51.81	103235	40.12	44149	36.44
Total Harvested & Other Farm Land	58693	100.00	226574	100.00	257293	100.00	121133	100.00
Farms Operated--- Total Acreage 1974	58693		225700		255527		120308	
Difference	0		- 874		- 1766		- 825	

Table 9 (Cont'd)

	Pope County		Saline County		Williamson County	
	Acres	% of all Farmland	Acres	% of all Farmland	Acres	% of all Farmland
Crop Land Harvested:						
Corn	11698	8.66	33285	19.59	10682	8.77
Soybeans	10236	7.58	37322	21.96	11669	9.58
Wheat	4316	3.20	10758	6.33	3043	2.50
All Hay	13261	9.82	6410	3.77	5195	4.26
Oats	319	.24	224	.13	213	.17
Other Crops	2142	1.59	2529	1.49	898	.74
Total Crops Harvested	41972	31.09	90528	53.27	31700	26.02
Other Farm Land:						
Plowland Pasture-	37366	27.66	27257	16.04	30702	25.19
All Other Pasture- -- All Land Pastured						
All Other Land	55737	41.25	52157	30.69	59460	48.79
Total Other Farm Land	93103	68.91	79414	46.73	90162	73.98
Total Harvested & Other Farm Land	135075	100.00	169942	100.00	121862	100.00
Farms Operated--- Total Acreage 1974	135016		169531		121877	
Difference	- 59		- 411		- 15	

Source: Illinois Agricultural Statistics, 1974
Illinois Cooperative Reporting Service, IL. Dept. of Agricutlure

Table 10

FARM CROPS HARVESTED BY ACRE, BY COUNTY AND BY YEAR

		Corn Harvested Acreage	Soybeans Harvested for Grain Acreage	Oats Harvested for Grain Acreage	Wheat Harvested for Grain Acreage	Barley Harvested for Grain Acreage	Rye Harvested for Grain Acreage	Sorghum Harvested for Grain Acreage	All Hay Cut Acreage	Popcorn Harvested Acreage	Vegetables Harvested Acreage	Other Crops Harvested Acreage
Franklin Co.	1970	33530	57776	605	11264	180	109	345	5991	-----	30	312
	1971	28790	65673	632	11593	28	134	1586	6510	-----	18	203
	1972	22424	67532	187	18598	268	108	1074	6040	-----	28	255
	1973	23208	73834	217	24471	81	121	1465	6824	-----	2	202
Gallatin Co.	1970	61366	29829	171	7808	46	75	26	1439	3504	---	11
	1971	47606	41508	112	11069	53	85	1363	1595	1555	20	---
	1972	39340	54551	13	14019	42	102	638	2396	1578	---	---
	1973	41486	63222	80	14831	---	56	669	1530	1158	---	---
Hamilton Co.	1970	41607	68212	767	15856	---	400	825	7305	159	---	62
	1971	32920	79096	1458	14912	42	37	2921	5763	22	---	1
	1972	29413	79524	368	24717	---	62	1780	6059	41	---	40
	1973	31514	87569	812	24707	122	85	1739	8674	12	---	---
Hardin Co.	1970	3998	230	148	-----	---	---	40	8985	120	---	---
	1971	3998	230	148	-----	---	---	40	8985	120	---	---
	1972	3168	532	48	-----	---	---	40	6605	120	---	---
	1973	3168	532	48	-----	---	---	40	6605	120	---	---
Jackson Co.	1970	36375	33275	536	17131	608	138	602	12126	-----	400	609
	1971	32856	36974	1081	17976	462	124	1437	11629	-----	215	809
	1972	25566	45266	817	22328	340	158	866	11352	-----	47	915
	1973	24789	47532	568	21867	269	322	750	11573	-----	23	955

Table 10
(Continued)

		Corn Harvested Acreage	Soybeans Harvested for Grain Acreage	Oats Harvested for Grain Acreage	Wheat Harvested for Grain Acreage	Barley Harvested for Grain Acreage	Rye Harvested for Grain Acreage	Sorghum Harvested for Grain Acreage	All Hay Cut Acreage	Popcorn Harvested Acreage	Vegetables Harvested Acreage	Other Crops Harvested Acreage
Jefferson Co.	1970	41825	72080	494	14481	60	38	67	14808	210	42	490
	1971	39188	78598	1214	15844	85	27	704	14270	335	25	271
	1972	35315	79753	887	23550	102	16	1942	15137	365	22	257
	1973	33609	78289	491	23455	91	76	1614	15116	365	10	305
Perry Co.	1970	31627	43024	1131	14777	167	248	241	16092	----	16	163
	1971	24888	41682	1807	13085	384	90	2204	13362	42	---	242
	1972	19731	31635	913	15176	493	21	2332	10592	36	---	214
	1973	17038	30062	276	12856	173	30	2222	12413	----	---	289
Pope Co.	1970	7449	7116	300	865	3	20	93	7806	311	---	88
	1971	9820	3983	77	1361	14	---	827	8741	15	---	10
	1972	12200	8520	300	4178	268	150	1964	12700	15	---	10
	1973	11698	10236	319	4316	295	140	1662	13261	37	---	1
Saline Co.	1970	40489	27950	421	8385	81	196	283	8316	384	1	1
	1971	37400	33656	533	8503	57	284	1249	6462	296	2	1
	1972	35489	35574	260	11428	70	25	608	6822	500	---	1
	1973	33285	37222	224	10758	248	236	500	6410	603	---	1
Williamson Co.	1970	14226	11776	323	549	7	8	498	8173	3	7	122
	1971	13870	12309	321	3309	108	89	357	6034	----	175	118
	1972	11443	12601	433	3226	249	101	155	6038	32	6	181
	1973	10682	11669	213	3043	195	31	178	5195	----	126	52

Source: Illinois Agricultural Statistics Annual Summary, 1973, 1974.
Illinois Cooperative Reporting Service, Illinois Department of Agriculture.

Land classified as idle, wasteland, woods, and farm lots (all other land) accounts for large areas of land in each county ranging in size (1973) from 25,586 acres in Gallatin County to 75,664 acres in Jackson County. Included in this category is land in private farm ownership; not included are Federal or State or Park lands.

Conservation Practices as Factors in Soil Erosion

Conservation practices in the area of water management are the primary mechanisms by which agriculturally based erosion can be reduced. The current trend in implementing conservation practices is for farmers/landowners to proceed on a voluntary basis with technical assistance from the Soil Conservation Service and a small amount of Federal funding per county compared to total need. The conservation practice factor is represented in the Universal Soil Loss Equation by the letter P.

Conservation Practices Available

The following is a list of conservation practices available to control erosion. Since all of the practices listed reduce erosion, they have a beneficial effect on water quality.

1. No-Till Planting

The term "no-till" refers to planting in narrow slots opened by a fluted coulter or other device without tillage. The planting can be in chemically killed meadow or winter cover, small-grain stubble, chopped cornstalks, or other crop residues. The residue from prior crops acts as mulch to protect the soil surface against erosion during the highly vulnerable crop-establishment period, during the growing season, and after harvest. Adequate residue cover reduces sealing and crusting of the soil surfaces. No-till planting reduces compaction of the soil by farm implements and significantly reduces planting time.

Where residues provide nearly complete surface cover, no-till planting can be the most effective year-round erosion control practice for intensive grain production. No-till planting in chemically-killed sod can reduce soil loss to less than five percent of that from the conventional plow, smooth, plant and cultivate system. Three tons or more of uniformly distributed cornstalks per acre can reduce soil loss by about 85 percent on moderate slope lengths. Other erosion control practices must be used in conjunction with no-till planting.

No-till planting without surface residues is not recommended as an erosion control practice. The advantages of no-till may be partially offset by problems inherent in no-plow systems. More herbicides and insecticides are usually required than with plow systems.

2. Other Conservation Tillage

While somewhat less effective, other conservation systems involving a small amount of tillage can be adapted to a broader range of soil and climatic conditions than no-till. These systems usually replace moldboard plowing with some form of non-inversion tillage to retain some residue mulch on the surface. In some of the systems, a chisel, field cultivator, or disk is used over the entire area. In others, row zones are tilled while the inter-row zones are left untilled with the residue cover intact. Strip tillage is highly effective when rows run across the slope. If they run up and down slope, runoff may flow into the tilled zone and cause erosion.

3. Sod-Based Rotations

Sod-based rotations have been successfully used for many years to reduce erosion from the conventional plow-based systems. Soil loss from a good quality grass and legume meadow is negligible, and when the sod is plowed out, residual effects improve infiltration. These effects are significant in the first and second years after sod is inverted. With good fertility management, annual soil losses from four-year rotations of wheat, hay, and two years of conventionally planted corn usually average about one-third of those from conventionally planted continuous corn.

Sod-based rotations with conventional tillage also provide better control of some plant diseases and pests, reducing the amount of pesticides and herbicides required. Legumes in the meadow mixture increase the amount of nitrogen in the soil and reduce the amount of chemical fertilizers needed.

4. Meadowless Rotations

A row crop like soybeans followed by a fall-seeded grain can reduce erosion by shortening the time the soil is bare, but rotating two row crops or a row crop and small grain has far less erosion control than a sod-based system. Soybeans following corn or grain sorghum lose less soil than second-year soybeans, but corn after soybeans has a higher erosion potential than corn after corn. Any rotations, however, aid in control of some diseases and pests, and may reduce the amount of particular herbicides required.

5. Winter Crop Cover

On plowed ground, shredded stalks of corn or sorghum harvested only for grain will provide more protection during the winter than a late-seeded small grain winter cover. However, a winter cover seeded early enough to attain good fall growth is beneficial following crops that leave little residue cover and in fields where the corn stalk is harvested for silage or other use.

Where soil wetness in the spring is a problem, the early spring growth of a wheat cover crop permits earlier corn planting because it uses the water in the soil. When moisture supplies are critical, however, the water used for growth of the winter cover may deprive the spring crop of needed moisture.

6. Improved Soil Fertility

Improving soil fertility to increase yields can substantially reduce soil erosion because of improved crop canopy, increased water use by plants, and the increased amount of residue for soil protection.

7. Timing Field Operations

Erosion data indicate that fall plowing for corn will generally increase the annual soil loss by at least ten percent over spring plowing, and by twenty to one hundred percent over a no-plow system. Fall plowing exposes the soil to the erosive force of thaw runoff and early spring rains. Delaying spring plowing and planting beyond the optimum dates increases the erosion potential.

8. Plow-Plant Systems

In plow-plant and wheeltrack-plant systems the field is turnplowed but secondary tillage is minimized. Plant residues are covered, but the surface remains rough and cloddy after planting. The rough surface decreases sealing, increases surface retention of excess water, and reduces runoff velocity. Erosion from moderate rains is furthur reduced by the rough surfaces, but when runoff is substantial, the surface has no protection. If the rough surface is to be maintained, however, weeds must be chemically controlled.

9. Contouring

Contouring is widely recommended for erosion control where surface drainage is not a problem. The crop rows follow the field contours across the slope to slow runoff. Contouring provides excellent erosion

control for moderate rainstorms. The average soil loss reduction from contouring is about 50 percent on moderate slopes, less on steeper slopes.

On steep dissected topography, the practice is incompatible with the use of massive multiple-row equipment. On poorly drained soils, contouring may aggravate wetness problems.

10. Contour Stripcropping

Much more effective than contouring alone is alternate strips of sod or close growth crops with strips of row crop. The sod strips serve as filters if rows break. High-quality sod strips reportedly have filtered 75 percent or more of the suspended soil from the runoff from the cultivated strips.

Stripcrop systems generally use a four-year rotation -- two years of meadow, one of row crop, and one of small grain in which new meadow is established. Stripcropping three-year systems of meadow, row crop, and small grain is less effective.

11. Terraces

Terrace systems support contouring by preventing serious rills and field gullies when contour rows break. They reduce slope length by dividing the overall slope into segments. Excess water is "walked" off the field through the nearly level terrace channels to a grassed outlet, or it is removed through a subsurface drain. Up to 80 percent of the soil moved from the between-terrace strips is deposited in the terrace channels.

Terrace systems have the highest initial cost of all the conservation practices, and they require continuous maintenance. However, they do permit more intensive cropping on sloping land.

12. Grassed Outlets

Grassed outlets channel runoff from contoured or graded rows or from terrace channels and remove it from the field. They are a highly effective water control practice. Disadvantages include establishment and maintenance problems and imcompatibility with use of large farm equipment and with use of herbicides to control grass in the row crops.

13. Ridge Planting

The term ridge planting refers to rows planted on existing or pre-formed ridges from which the residues have been moved to the between-row furrows. The ridges warm and dry more quickly than the furrows to facilitate earlier planting. When the ridges are on the contour or very slight row gradient, they function as small, closely spaced terraces and are very effective in controlling erosion. The practice is less effective when the rows are not on the contour, but large amounts of residue in the furrows can substantially reduce soil loss even with row gradients up to six or eight percent. If the ridges break with heavy rains, deep rilling may occur. Disadvantages include problems with stand establishment, fertilizer placement and weed control.

14. Change in Land Use

Change in land use is sometimes the only solution to erosion problems. Sometimes a change to annual cropping of small grains and other closely seeded crops, with appropriate tillage practices and residue managment, will suffice to control erosion. Properly managed hay or pasture furnished adequate erosion control over a wide range of slopes through most humid sections of the country. Managed permanent woodland with duff and underbrush cover permits almost no erosion.

15. Other Practices

Land Forming

Land forming can sometimes alleviate the problems of irregular topography for contouring or terracing and also improves surface drainage.

Closer Row Spacing

Rows on 30-inch spacing hasten development of an effective canopy and provide a more complete canopy cover than the traditional 40- and 42-inch spacing. Tests have shown some associated reduction in erosion, particularly during the first two months of the crop year.

Sediment Traps

Vegetative sediment filters, settling basins, and sediment traps represent another approach to sediment reduction. They are not erosion control practices, but they can be very effectively used to trap sediment near their source.

The cost of these conservation practices vary greatly. The following table lists these costs as reported by the Soil Conservation Service in October of 1973:

Table 11
AVERAGE TREATMENT COSTS PER ACRE

Contouring	$ 2.30/acre
Terracing	1.44/foot
Stripcropping	5.00/acre
Conservation Tillage	4.00/acre
Conversion to Grass	50.00/acre
Grassed Waterways	500.00/acre
Structures	2300.00/each
Pasture Planting	55.00/acre
Pasture Improvement	28.00/acre
Tree Planting	30.00/acre
Established Vegetation on Other Land	150.00/acre

Conservation Practices Within the 208 Area

In order to realistically assess the extent of soil conservation practices which occur each year in the ten-county 208 area, a county by county survey and analysis was conducted. This includes those conservation measures which were implemented by the various County Soil and Water Conservation Districts, with the assistance of other agencies, particularly the U.S. Soil Conservation Service. By making an observation of the soil conservation practices of each district, a better assessment of projected conservation practices may be made based upon current trends and the existing situation with respect to limited federal funding.

Each County Soil and Water Conservation District in the 208 area has cooperated in furnishing information about soils, soil problem areas, conservation practices, conservation programs, cooperators, annual programs and plans. The data received would be far too lengthy and detailed for this document; therefore, the most important and relevant data was compiled and summarized in table form. Both the Soil Conservation Service and the Agricultural Stabilization and Conservation Services offices in each county assisted and provided pertinent information.

Table 12

208 AREA SOIL AND WATER CONSERVATION DISTRICTS
CONSERVATION PRACTICES: ACCOMPLISHMENTS TO DATE

Conservation Practices	Unit of Measure	Franklin	Gallatin	Hamilton[1]	Jackson	Jefferson	Perry	Pope-Hardin	Saline	Williamson
Conservation Cropping System	acres	18,166	57,337	58,043	61,649	40,000	46,400	32,249	18,520	10,623
Contour Farming	acres	1,628	663	90	4,468	2,000	1,350	21,231	2,023	897
Pasture Improvement	acres	32,078	13,090	11,802	38,173	29,000	35,589	84,848	18,529	51,085
Ponds	#	471	150	421	477	433	378	1,480	546	362
Crop Residue Management	acres	36,136	54,453	61,947	58,287	45,000	42,500	28,736	15,791	15,414
Pasture Management	acres	23,301	10,952	8,773	33,813	14,000	11,229	47,674	4,291	24,444
Tree Planting	acres	1,222	336	175	49,629	500	538	27,596	436	4,278
Woodland Improvement	acres	933	911	116	10,478	500	1,745	3,967	522	116
Woodland Impr. Harvesting	acres	921	2,081	520	25,999	0	74	NA	218	1,316
Mains & Laterals for Drainage Districts	ft.	1,754,955	345,896	657,050	105,600	---	209,800	435,100	355,133	---
Surface Field Ditches	ft.	73,071	108,460	509,989	1,288	---	183,500	26,100	257,242	---
Tile Needs	ft.	NA	1,752,229	439,544	---	---	---	0	668,591	---
Critical Areas	acres	106	821	392	572	---	506	3,474	380	540
Grade Stabiliz. Structures	#	55	80	95	166	93	156	76	112	30
Conservation Tillage	acres	21,339	37,694	12,813	15,325	10,000	25,404	7,514	20,892	7,725
Terraces & Diversions	ft.	79,540	86,703	36,754	131,745	32,000	18,000	211,200	79,915	18,960

[1]Hamilton Co. also reported 525 acres of Grassed Waterways

Source: Information obtained from County Soil and Water Conservation Districts, Soil Conservation Service, and Agricultural Stabilization and Conservation Service Offices.

Table 13

208 AREA SOIL AND WATER CONSERVATION DISTRICTS
CONSERVATION PRACTICES: REMAINDER TO BE DONE

Conservation Practices	Unit of Measure	Franklin	Gallatin	Hamilton	Jackson	Jefferson	Perry	Pope-Hardin	Saline	Williamson
Conservation Cropping System	acres	152,547	70,212	Not	72,446	180,000	13,655	31,897	115,121	67,015
Contour Farming	acres	13,123	---	Provided	16,990	47,000	---	20,000	---	4,721
Pasture Improvement	acres	5,091	5,019	"	13,397	26,000	22,131	16,969	12,480	27,000
Ponds	#	458	150	"	338	400	360	500	500	600
Crop Residue Management	acres	134,577	33,096	"	47,000	40,000	27,000	25,000	72,481	35,000
Pasture Management	acres	37,169	7,157	"	20,971	43,000	21,569	31,214	26,718	26,535
Tree Planting	acres	3,778	3,664	"	7,800	4,000	6,093	4,800	3,964	10,000
Woodland Improvement	acres	19,683	28,689	"	70,000	4,000	24,246	69,592	18,578	36,000
Woodland Impr. Harvesting	acres	19,695	33,919	"	NA	---	32,000	NA	20,282	15,000
Mains & Laterals for Drainage Dists.	ft.	1,031,943	1,654,100	"	15,000	---	---	200,000	1,644,800	---
Surface Field Ditches	ft.	2,063,886	391,500	"	NA	---	---	75,000	742,750	---
Tile Needs	ft.	NA	12,747,770	"	NA	---	---	---	5,331,400	---
Critical Areas	acres	1,242	479	"	8,000	---	---	2,000	600	1,500
Grade Stabiliz. Structures	#	315	320	"	---	150	---	300	388	150
Conservation Tillage	acres	149,374	52,300	"	67,000	40,000	---	36,331	80,000	30,000
Terraces & Diversions	ft.	3,977,000	83,300	"	---	18,000	---	13,200,000	88,085	180,000

Source: Information obtained from County Soil and Water Conservation District, Soil Conservation Service, and Agricultural Stabilization and Conservation Service Offices.

Table 14

208 AREA SOIL AND WATER CONSERVATION DISTRICTS
CONSERVATION PRACTICES: EFFECTIVENESS AND YEARS REQUIRED TO MEET OBJECTIVES*

Conservation Practices	Unit of Measure	Franklin	Gallatin	Hamilton	Jackson	Jefferson	Perry	Pope-Hardin	Saline	Williamson
Conservation Cropping System	Comment + yrs.*	No Response	15	No Response	yes 30-40	50	Fair 10	Fair 35-40	15	Good 40
Contour Farming	"	"	---	"	yes 10-15	---	---	Fair 30-40	---	Good 50
Pasture Improvement	"	"	15-20	"	yes 10-15	25	Fair 20	Good 10-15	15-20	Good 20
Ponds	"	"	19-20	"	yes 20-30	30	Fair 20	Good 50	19-20	Excellent 20
Crop Residue Management	"	"	10-15	"	yes 15-20	10	Fair 15	Continuing	10-15	Good 35
Pasture Management	"	"	15	"	yes 20-25	25	Fair 22	Good 15-20	22	Good 30
Tree Planting	"	"	Need: Accelerate	"	yes 10-15	100	Poor	Good 5-10	Need: Accelerate	Need Cost Incentive 50
Woodland Improvement	"	"	Need: Accelerate	"	yes 50-75	100	Poor	Poor 20-40	Need: Accelerate	Need Cost Incentive 50
Woodland Impr. Harvesting	"	"	Need: Accelerate	"	---		Poor	No Record	Need: Accelerate	Need Cost Incentive 50
Mains & Laterals for Drain. Dists.	"	"	Increase Prod.**	"	yes 10-20		---	Fair 30-40	Increase Prod.**	---
Surface Field Ditches	"	"	Increase Prod.	"	NA		---	Fair 30-40	Increase Prod.	---
Tile Needs	"	"	Increase Prod.	"	NA		---	---	Increase Prod.	---
Critical Areas	"	"	Need: Accelerate	"	yes 10-15		---	Good 20	Need: Accelerate	--- 20
Grade Stabilization Structure	"	"	Need: Accelerate	"	---	40-50	---	Poor 50	Need: Accelerate	Need Cost Incentive 50
Conservation Tillage	"	"	Need: Accelerate	"	yes 30-40	40	---	Poor 20	Need: Accelerate	Good 80
Terraces & Diversions	"	"	Need: Accelerate	"	---	Forever	---	Poor 50	Need: Accelerate	Slow 40

*Effectiveness in Responding to Objections; and, Years Needed to Meet Objectives.
** Increase Prod. = Increase Production and provide for more intensive land use.

Source: Information obtained from County Soil and Water Conservation District, Soil Conservation Service, and Agricultural Stabilization and Conservation Service Offices.

Table 15
208 AREA SOIL AND WATER CONSERVATION DISTRICTS
CONSERVATION PROGRAMS: ACCOMPLISHMENTS TO DATE

	Unit of Measure	Franklin	Gallatin	Hamilton	Jackson	Jefferson	Perry	Pope-Hardin	Saline	Williamson
# Conservation Plans Developed & Revised	#	823	438	459	597	706	344	754	724	402
Average # of Plan Revisions	#/yr.	10	5	---	11	10	10	8-(240)	10-(200)	---
Detailed Soil Survey	acres	49,705	209,900	29,639	332,592	18,270	113,749	360,966	245,760	Ent.Co.Dst. 227,025
Land Adequately Treated-Protected	acres	48,599	148,754	82,788	142,576	67,319	123,626	167,038	46,221	92,439
Conserv. Practices Applied										
a. Cropland	acres	17,586	80,718	NA	59,095	40,000	70,700	NA	80,718	10,673
b. Pasture	acres	32,078	9,626	NA	33,570	29,000	10,659	NA	21,628	24,440
c. Forestland	acres	40,119	18,614	NA	10,458	500	7,226	NA	15,157	5,710
Participates at Mine Reclam. Meetings	---	NA	yes	NA	yes	yes	yes*	yes (1)	yes	yes (23)
Furnishes Natural Resource Info.	---	yes	yes	NA	yes	yes (95)	---	0	yes	yes (22)
Conducts Conservation Tours w/Schools	---	yes	yes	NA	yes (3)	no	---	yes (15)	yes	yes
Encourages Outdoor Classrooms	---	yes	yes	NA	yes (2)	yes	yes (2)	yes (2)	yes	4
Other Social Activities	---	yes	yes	NA	yes	---	---	---	yes	---
Watershed RC&D Program:										
Land Treatment	acres	Member RC&D	5,499	NA	yes	New Member	---	yes (3)	18,114	---
Drainage Dist.**	# Ditches or comment		2	NA	yes	Shawnee RC&D	---	yes	2	3

*The Perry Co. SWCD is the official mine reclamation plan review committee in Perry Co. It often reviews mining permit application amendments.
**Mainly clearing out and/or enlarging main ditches.
NA=Not applicable or info. not available.

Source: Information obtained from County Soil and Water Conservation District, Soil Conservation Service, and Agricultural Stabilization and Conservation Service Offices.

Table 16

208 AREA SOIL AND WATER CONSERVATION DISTRICTS
CONSERVATION PROGRAMS: REMAINDER TO BE DONE

	Unit of Measure	Franklin	Gallatin	Hamilton	Jackson	Jefferson	Perry	Pope-Hardin	Saline	Williamson
# Conservation Plans Developed & Reviewed	#	930	128	741	500	322	118	812	212	590
Average # of Plan Revisions	#/yr.	---	90	---	350	20	90	148	180	---
Detailed Soil Survey	acres	201,444	None	248,761	None	345,090	169,750	None	None	None
Land Adequately Treated/Protected	acres	202,550	61,146	180,872	243,303	265,427	159,874	193,922.	199,539	92.439
Conservation Practices Applied										
a. Cropland	acres	153,127	46,831	---	75,000	180,000	103,241	NA	52,922	10,673
b. Pasture	acres	5,091	8,483	---	18,000	26,000	22,131	NA	9,381	24,440
c. Forestland	acres	7,001	27,086	---	78,000	4,000	32,622	NA	19,743	5,710
Watershed RC&D Program										
Land Treatment	---	Member	4,526ac.	---	---	Member	---	yes	29,371	---
Drainage Dist.	---	RC&D		---	---	Shawnee RC&D	---	yes (1)	13	---

Source: Information obtained from County Soil and Water Conservation District, Soil Conservation Service, and Agricultural Stabilization and Conservation Service Offices.

Table 17

208 AREA SOIL AND WATER CONSERVATION DISTRICTS

EFFECTIVENESS IN RESPONDING TO OBJECTIVES; AND, YEARS NEEDED TO MEET OBJECTIVES

		Franklin	Gallatin	Hamilton	Jackson	Jefferson	Perry	Pope-Hardin	Saline	Williamson
Development of Conservation Plans	Effectiveness*	---		---	Good	---	Good	Poor	---	Very Effect.
	Yrs. to Obj.**	---	20-30	---	20	35	30	40-50	20	Needs Accele
Conservation Plan Revisions, Ave.	Effectiveness	---		---	---	---	Fair	Used in All	---	---
	Yrs. to Obj.	---	18-20	---	20-25	35	10	15-20	18-20	---
Detailed Soil Survey	Effectiveness	---	Used Ex-	Contract	---	---	Fair	Used in All	Used Ex-	---
	Yrs. to Obj.	---	tensively	w/SCS & Co.Bd.(5)	---	---	---	Cons.Plng.	tensively	---
Land Adequately Treated/Protected	Effectiveness	---		---	Good	---	Fair	Poor	---	---
	Yrs. to Obj.	---	25	---	50-75	90	34	70	35	---
Conservation Practices										
a. Cropland	Effectiveness	---	---	---	Good	---	Fair	---	---	Needs Cost
	Yrs. to Obj.	---	---	---	30-40	50	---	---	---	Incentives 50
b. Pasture	Effectiveness	---	---	---	Good	---	Fair	---	---	Needs Cost
	Yrs. to Obj.	---	---	---	15-20	25	---	---	---	Incentives 50
c. Forestland	Effectiveness	---	---	---	Good	---	Fair	---	---	Needs Cost
	Yrs. to Obj.	---	---	---	50-75	100	---	---	---	Incentives 50
Watershed RC&D Program Land Treatment Drainage Dist.	Effectiveness	---	Reduce	---	---	---	---	Fair	Reduce	Excellent
	Yrs. to Obj.	---	Flooding & Provide Drainage	---	---	---	---	20-30	Flooding & Provide Drainage	

*Effectiveness in Responding to Objectives

**Years Needed to Meet Objectives

Source: Information obtained from County Soil and Water Conservation District, Soil Conservation Service, and Agricultural Stabilization and Conservation Service Offices.

Although individuals do undertake various conservation practices on their own, many call upon the assistance available from Soil and Water Conservation Districts. Soil and Water Conservation Districts have the authority to make surveys and investigations, conduct research, and publish plans. They develop plans for the conservation of soil and water resources and for the control and prevention of soil erosion, floodwater and sediment damages within the districts. Such plans specify in detail the actions, procedures, performances and avoidances necessary or desired to carry out the plans. Specifications in the plans include engineering operations, methods of cultivation, growing of vegetation, cropping programs, tillage practices, and changes in the use of land. The Districts, with the Department of Agriculture's assistance, publish such plans and information and bring them to the attention of the landowners/occupiers within the district.

Each Soil and Water Conservation District is responsible for erosion control and prevention operations. They develop agreements, make appropriatations, and furnish financial and technical aid in the carrying out of erosion control and flood prevention operations within the district.

A District may acquire, manage and dispose of property. It may also make available to landowners or occupiers the use of machinery, material and equipment to further the conservation of soil and water resources. A District may construct, improve, operate and maintain structures. It may cooperate with individuals and governmental agencies for purposes of conservation of renewable natural resources, water supply and recreational projects. Cooperative agreements with individuals or agencies may include provisions to plan, construct, operate and maintain programs and projects relating to the conservation of the renewable resources of soil, water, forests, fish, wildlife and air in the state. Such provisions are for the purposes of controlling or preventing soil erosion, floods, flood waters, sediment damages and impairment of dams and reservoirs, and to assist in maintaining the navigability of rivers and harbors.

Soil and Water Conservation District directors may require contributions in money, services, materials, or otherwise. They may require landowners to enter into and perform such agreements or covenants with respect to such lands which will prevent or control erosion thereon, or promote the welfare of the lands within the district.

A district may promulgate ordinances, rules, regulations, orders, contracts, forms and other documents, and must file such documents with the Department of Agriculture.

Districts may develop and adopt land use regulations for the purpose of governing the use of lands within the district in order to conserve soil, soil resources, water, and water resources, and to prevent soil erosion, flooding, and sediment damage. Specific land use regulations may be developed and adopted to (1) require engineering operations for construction of terraces, terrace outlets, check dams, dikes, ponds, ditches and other necessary structures; (2) require observation of particular methods of cultivating, including contour cultivating, contour furrowing, strip cropping, seeding and planting of lands; (3) require the permanent retirement from cultivation of highly erosive areas and areas on which erosion cannot be adequately controlled when cultivated; and (4) provide through other means or measures control of soil and water resource conservation.

In regard to the new law enacted by the adoption of H.B. 818, Soil and Water Conservation Districts, within two years after adoption of the bill must develop and adopt a soil erosion and sediment control program and standards which are technically feasible, economically feasible, and consistent with the state program and guidelines. Before adopting or revising conservation standards, each district must hold a public hearing.

District boundaries must remain the same, but provision is made for the removal of a municipality from the district, if made by resolution within two years.

There are provisions in the law for filing and processing of complaints for sediment and erosion damage incurred by any land disturbing activity. The District shall:

1. Notify landowner and occupier of the complaint;
2. Determine whether standards are being observed;
3. Notify landowner and occupier of finding;
4. Seek voluntary compliance with the standards;
5. File complaint.

If a schedule for compliance has not been entered into within one year, the District Board shall hold a public hearing to determine the reason for non-compliance. The Department of Agriculture shall then review the complaint and the findings; may hold a formal hearing to determine why standards are not being observed; and must publish and make the findings available to the public.

In Section 406 of Title IV, Abandoned Mine Reclamation of PL 95-87, the new Surface Mining Control and Reclamation Act, the reclamation of rural lands is addressed. This section specifically states that "the Secretary of Agriculture shall utilize the services of the Soil Conservation Service." Funds from the Act will be received by S.C.S.; but it will require a cooperative effort between S.C.S. and the Soil and Water Conservation Districts to reduce the water pollution problem from mines, and particularly to implement abandoned mine reclamation.

The Best Management Practices for the control of erosion from the State Task Force on Agriculture Non-Point Sources of Pollution have been evaluated and rated for effectiveness by the area 208 Land Use and Agriculture Committee. A total of thirty-five conservation measures have been rated for their effectiveness of controlling erosion in the ten-county area for the following six uses:

(1) Cropland;
(2) Pasture and Hayland;
(3) Other Lands (Wildlife, Recreation, and Idle Land);
(4) Farmsteads (Dwellings, Farm Buildings, Lots, Gardens, and Other);
(5) Water Areas (Ponds, Lakes, and Streams; Their Banks and Shorelines; and Adjacent Land Areas); and
(6) Construction Areas (Land Disturbed by Construction other than Surface Mined Lands).

The following is a description of each of the conservation measures found in the table.

These descriptions were developed by the Scil Erosion and Sedimentation Subcommittee of the State Task Force on Agricultural Non-Point Sources of Pollution.

Table 18
CONSERVATION MEASURES RATED BY EFFECTIVENESS
IN SELECTED EROSION SITUATIONS

Conservation Measures	Cropland	Pasture/ Hayland	Other Lands	Farmsteads	Water Areas	Construction Areas
Access Road Protection		3	2	1	1-2	2-3
Conservation Cropping System	1					
Conservation Tillage	1-3					
Contour Farming	2					
Contour Stripcropping	3					
Cover Crops	2					
Critical Area Planting		2	2-3			1
Crop Residue Use	1		1	1-2	1	2
Debris Basin		3	1		1-2	1-2
Diversion	3	3	2	1-3	1-3	1
Field Border	2-3				1	
Field Stripcropping	3					
Grade Stabilization Structure	2	2	1	1-2	1-2	1-2
Heavy Use Area Protection			1	1-2		2
Land Use Change to Conservation Use	2	2	2	1-2	1	
Landscaping						1
Livestock Exclusion			1	1-2	1	
Mulching			2			1
Pasture and Hayland Management		1				
Pasture and Hayland Planting		1				
Pond		2				
Preservation of Permanent Vegetation			1		1	
Preservation of Water Areas and Wetlands			1		1	
Recreation Area Improvement			1			
Recreation Trail and Walkway Protection			1-2			
Restriction of Size of Disturbed Area						1
Roof Gutters, Downspouts and Outlets				2		

Table 18
(Continued)

Conservation Measures	Cropland	Pasture/ Hayland	Other Lands	Farmsteads	Water Areas	Construction Areas
Site Selection						1
Spoilbank Protection					2	
Streambank Protection					1	
Timing of Construction Activities						1
Terraces w/Tile Outlet	2					
Terraces w/Waterway Outlet	2					
Tree Planting			1		2	3
Waterways (Grassed or Lined)	2	2	2	2-3	1	2

Ranking Scale: 1-3, 1 = most suitable
3 = least suitable

Source: Soil Erosion and Sedimentation Subcommittee of the State Task Force on Agricultural Nonpoint Sources of Pollution.

Access Road Protection

An access road is a travelway to fields for vehicles, animals, or both. The purpose of this practice is to provide easy access to fields without creating erosion and water quality problems.

Conservation Cropping System

Conservation cropping system is growing crops in combination with needed cultural and management measures. Cultural and management measures include, but are not limited to, applying lime, fertilizer, seed selection, seeding rates, weed control and timing of operations. This practice includes both continuous row cropping and rotations containing grasses and legumes.

The purpose of this practice is to reduce erosion, increase filtration of water by improving or maintaining a good physical condition and meet the need and desire of farmers for an economic return.

Conservation Tillage

Conservation tillage involves use of tillage methods that leave a protective cover of crop residue at the surface, or results in a rough surface, or a combination of the two. The protective residue or surface roughness is maintained through planting time and the early growth period when erosion damage is most likely to occur.

Tillage methods are:

Zero-till - Planting with no soil disturbance except in the immediate area of the seed row.

Chisel Planting - Seedbed preparation made by chisel plow or field cultivator leaving a protective cover of crop residue.

Strip Tillage - Seedbed prepared by a rotary tool that mixes soils and residue in strips.

Till Plant - Seedbed prepared by scalping old crop row to push soil and residue to the inter-row area.

Plow-Plant - Moldboard plowing and planting in the same operation or soon thereafter.

Wheel Track Planting - Moldboard plowing with planting in the wheel tract in a separate operation.

Conservation tillage reduces erosion by increasing infiltration, reducing raindrop splash effect, increasing surface storage of water and improving the physical condition of the surface layer.

This practice also reduces labor requirements and fuel costs. Crop residues left on the surface or incorporated in the surface, and a rough soil surface, is effective in controlling wind erosion.

Contour Farming

Contour farming is farming sloping cultivated land in such a way that plowing, land preparation, planting and cultivation are done on the contour. It reduces erosion on cultivated land.

Contouring is most effective on slopes of 2 to 7 percent. As the slope gradient increases, however, the length of slope in which contouring is effective decreases. During heavy rains, the build up of water between the rows may result in breakover of the row ridges and concentrations of runoff tend to become progressively greater with increased slope length. The following table provides approximate slope-length limits for effective contouring.

Table 19
LIMITS FOR EFFECTIVE CONTOURING PRACTICES

Slope (%)	Max. effective slope length (ft.)
2-3	400
4-6	300
7-9	200
10-12	100
13-24	60

Contour Stripcropping

Contour stripcropping is growing crops in a systematic arrangement of strips on the contour. The crops are arranged so that a strip of grass or small grain is alternated with a strip of row crop. The purpose is to

reduce erosion and improve water control. Wildlife food and cover are also provided.

Cover Crop

This practice uses close-growing grasses, legumes or small grains used primarily for seasonal protection and soil improvement. It usually covers the land for a period of one year or less. Cover crops are used to control wind or water erosion during periods when major crops do not furnish adequate cover and increase infiltration by improving the physical condition of the soil. They may also be used to provide temporary cover on rural construction areas.

Critical Area Planting

Critical area planting is done by planting vegetation such as trees, shrubs, vines, grasses, or legumes on critical areas (does not include tree planting mainly for wood products). It is done to stabilize the soil and reduce damages from sediment and runoff to downstream areas. Additional benefits include wildlife habitat improvement, beauty enhancement, and wind erosion control.

Critical area planting is useful on sediment producing highly erodible or severely eroded areas. It applies to (1) construction sites (dams, borrow areas, earth work); (2) highly eroded or gullied areas; (3) sand blowouts; (4) ditch bank sideslopes; (5) ditch berms and spoils; (6) surface mines areas; (7) development land needing permanent vegetation; and (8) disturbed areas needing temporary cover. It is not applicable to watercourses carrying a concentrated flow of water.

Crop Residue Use

This practice involves using plant residues to protect cultivated fields during the period from harvest to just prior to planting the next crop. Plant residues are left on the surface or anchored in the upper few inches. Crop residue use increases infiltration, reduces raindrop splash effect, increases surface storage of water, and improves the physical condition of the surface layer. Additional benefits include wind erosion control and additional wildlife food and cover.

Debris Basin

A debris basin is a barrier or dam across a watercourse, or located at another suitable location, to trap sediment. The purpose is to trap sediment and reduce or abate pollution by providing a storage basin.

Diversion

A diversion is a channel with a supporting ridge on the lower side constructed across the slope to divert water to sites where it can be used or disposed of at a stable outlet at a non-erosive velocity. Its purpose is to:

1. Divert water from areas where it may become polluted.
2. Divert water from areas where it may cause erosion.
3. Serve as sediment traps in some cases.
4. To divert polluted water to a disposal facility.

Field Border

This practice involves planting a border or strip of perennial grasses and legumes at the edge of a field or along channels and streams. The purpose is to control erosion, protect edges of fields that are used as turn strips or travel lanes for farm machinery, and to serve as filter strips. Wildlife food and cover is also provided.

Field Stripcropping

Field stripcropping is growing crops in strips across the slope maintaining straight or nearly straight rows. The crops are arranged so a strip of grass or small grain is alternated with a strip of row crop. The purpose of the practice is to reduce erosion on sloping cropland where contour stripcropping is not practiced. Wildlife food and cover are provided.

Grade Stabilization Structure

This practice involves construction of a structure to stabilize the grade or to control gully head erosion into natural or artificial channels. Grade stabilization structures prevent the development or advance of gully heads due to surface water concentrations.

Heavy Use Area Protection

Heavy use area protection involves protecting heavily used areas by establishing vegetative cover, by surfacing or by installing needed structures. This practice is used to prevent erosion from areas subjected to sustained use by people, animals, or vehicles. Wildlife food and cover may also be provided.

Land Use Change to Conservation Use

This practice requires a change to a less erosive use, e.g., cropland to pastureland, pastureland to woodland. The purpose is to control erosion and reduce water runoff through the provision of a filter strip for sediment and other pollutants. This practice may be used as a green belt adjacent to water areas. Wildlife habitat may also be improved.

Livestock Exclusion

This practice involves keeping livestock out of any area where grazing is harmful or otherwise undesirable. The purpose is to maintain the vegetative cover needed to prevent erosion and to control animal waste. Wildlife habitat may also be improved.

Mulching

Mulching involves applying plant residues or other suitable materials to the soil surface. Mulching reduces runoff and erosion and helps to establish plant cover by conserving moisture.

Pasture and Hayland Management

This practice includes the needed cultural and management measures required to treat and use pastureland and hayland. The purpose is to provide quality and quantity of forage desired while providing protection from erosion.

Pasture and Hayland Planting

This practice involves establishing or re-establishing stands of adapted species of forage plants. This practice reduces erosion and provides quality and quantity forage plants.

Preservation of Permanent Vegetation

Permanent vegetation preservation involves the preservation and maintenance of existing trees, shrubs, grasses, and herbs. The purpose is to provide ground cover to prevent erosion and to filter out sediment and other pollutants, and prevent their entering streams or water bodies. This practice may also provide food and cover habitat for wildlife, as well as beautify, and provide site and sound screening.

Preservation of Water Areas and Wetlands

This practice protects and preserves natural and man-made water areas and wetlands. The purpose is to maintain these areas as natural sediment traps to improve or maintain water quality downstream. These areas may also provide wetland habitat for wildlife recreation and aesthetic values.

Landscaping

Landscaping involves utilizing plant materials and possibly modifying the land surface to protect the area from soil erosion. Associated benefits include beautification and improved wildlife food and habitat. The purpose is to provide long-term protection from erosion while beautifying the site.

Site Selection

Selection of construction sites based on natural resource information is a feasible means to control erosion and sedimentation and to preserve agricultural land. The purpose is to select sites where erosion and sedimentation can be satisfactorily controlled.

Recreation Area Improvement

This practice involves establishing or thinning vegetation to improve an area for recreation use. The purpose is to protect the soil from erosion and to increase the attractiveness and usefulness of recreation areas.

Recreation Trail and Walkway Protection

A pathway through a recreation area should be prepared for pedestrian, equestrian, and bicycle travel. The purpose is to provide travel routes that are protected from erosion.

Restricting Size of Disturbed Area

This practice involves limiting the extent of earth disturbing activities for construction. The purpose is to limit the disturbed area to a size that can be managed without contributing excess sediment off the site.

Roof Gutters, Downspouts, and Outlet

This practice involves the use of devices to collect roof water runoff, convey it to ground level and dispose of safely without polluting clean water. The purpose is to dispose of roof water without causing erosion damage or polluting clean water.

Spoilbank Spreading

This practices involves the spreading of excavated materials over

adjacent land. The purpose is to establish vegetation along excavated areas to control erosion.

Streambank Protection

Streambank protection involves the stabilization and protection of banks, of streams, lakes or excavated channels by vegetative or structural means. The purpose is to prevent scour or erosion of the banks, to prevent sediment loads causing downstream damage or pollution, to prevent the loss of the land and facilities, and to maintain channel capacity. Streambank protection may provide food and habitat cover for wildlife improve the water area for recreation.

Terraces

A terrace is an earth embankment, channel, or a combination ridge and channel constructed across the slope. It may be outletted by either tile or waterways. Terraces are constructed to (1) reduce erosion, (2) reduce sediment content in runoff water, (3) intercept and conduct surface runoff at a non-erosive velocity to a stable outlet, (4) retain runoff for moisture conservation, (5) prevent gully development, and (6) reduce flooding.

Timing of Construction Activities

This practice involves the planning of construction activities to correlate with site protection and the timing of construction activities to avoid long periods of soil exposure to erosive forces.

Tree Planting

The purpose is to establish a stand of trees or shrubs where conversion of land or the reinforcement of an existing stand is desired in order to reduce erosion and sedimentation. Additional benefits include production of wood products, beautification, and wildlife habitat improvement.

Waterways

A waterway is a natural or constructed watercourse or outlet shaped or graded, and established in vegetation or lined with an erosion resistant material. Waterways are designed to dispose of runoff without erosion or flooding. They serve as outlets for terraces, diversions, or other concentrations of water.

Identification of Critical Erosion Areas

Through the cooperation of the soil and water conservation districts and the Soil Conservation Service, data was accumulated in defining the areas subject to severe erosion. This identification was accomplished by:

(1) identifying areas where the soil loss rate was, or could be, 10 or more tons/acre;

(2) an evaluation of general soil associations characteristically subject to severe erosion;

(3) an evaluation of land use practices which subject soils to erosion; and

(4) plotting these characteristics on a map.

A review of the Illinois Environmental Protection Agency network water quality data is inconclusive in relating that information to the impact caused by erosion on streams and lakes. Butts indicated in his Rector Creek - North Fork study that a relationship exists between high iron levels and current tillage practices.[1] However, iron concentrations are also high in streams where mining may be occurring in the watershed. Consequently, the use of iron concentrations within the 208 area to identify erosion impacts on water quality is severely limited.

Although the procedure furnished gross areas subject to critical erosion, it supported data contained in separate reports which identified sedimentation rates in reservoirs and streams.[2],[3]

The following table reflects the various rates of soil loss of inadequately treated land. It is apparent that cropland contributes approximately 85% of erosion from all land classes and the average areawide soil loss rate is 15.12 tons/acre per year.

Although the soil loss rates may be considerably higher than the "T" factor, or tolerance levels established for particular soil types, attention must be directed toward impact on water quality. The term soil loss is a misnomer; in actuality it is horizontal displacement - often measured in inches. It is unknown what percentage of any soil loss rate results as a particular stream load. Delivery ratios are unavailable.

However, excessive soil loss rates in close proximity to usable streams, or in significant volumes near tributaries to water supply reservoirs, provides a sufficient basis for concern. In that the area is dependent upon surface water supplies, areas with excessive soil loss rates pose a considerably greater impact and are of more concern than those areas located elsewhere. It should be emphasized that the 208 program focuses on water quality rather than soil productivity.

Table 20
ACREAGE AND AVERAGE GROSS SOIL LOSS
ON INADEQUATELY TREATED LAND
BY SELECTED CLASSES

	Cropland		Pasture		Total (Includes Other)	
	Acres	Rate	Acres	Rate	Acres	Rate
Franklin	97.-	14.6	30.0	3.1	129.3	11.8
Gallatin	45.9	13.0	14.4	4.2	68.5	9.8
Hamilton	91.6	16.1	20.5	2.8	118.0	13.2
Hardin	15.4	21.7	21.4	5.9	41.3	12.3
Jackson	96.3	16.9	45.5	4.2	192.2	10.5
Jefferson	163.8	14.4	46.8	4.3	216.1	12.0
Perry	105.4	13.7	22.1	3.5	140.2	11.6
Pope	28.0	19.7	35.7	4.7	72.0	10.9
Saline	53.2	14.6	19.5	3.7	86.5	11.1
Williamson	55.2	14.3	42.6	3.7	118.7	8.9
TOTAL	751.8	15.12	298.5	4.0	1,182.8	11.2

Source: Table 16, Supplemental Problem Assessment Report, Soil Erosion and Sedimentation Subcommittee, State Agriculture Task Force, March 2, 1978.

FOOTNOTES FOR CHAPTER 2

[1]Butts, T. A., et. al., Water Quality Evaluation of the Rector Creek - North Fork Saline River Drainage Basin, Illinois State Water Survey, Urbana, Illinois, 1976.

[2]Evans, R., et. al., Water Quality Investigations of Rend Lake and Cedar Lake, Illinois State Water Survey, Urbana, Illinois, 1978.

[3]Narayan, A. S., et. al., Economic Analysis of Erosion and Sedimentation, Crab Orchard Watershed, AERR, Department of Agricultural Economy, University of Illinois, Urbana, Illinois, 1974.

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Chapter 3

NUTRIENT RUNOFF FROM AGRICULTURE

Within the 10 county 208 area significant amounts of nutrients are applied to the soil in the form of commercial fertilizers. The use of these fertilizers is a standard agricultural practice. In most cases these nutrients are used carefully and judiciously. Many farm operators have attended schools of agriculture and/or special seminars on fertilizer use and are knowledgeable of the proper methods of storage and application, including determining the appropriate amount of fertilizer and the proper timing of its application. Further, the costs of fertilizer application encourage proper use. The threat from these farm operators of polluting streams is a small one. However, there may be many farm operators who neglect to take necessary precautions, which can result in excessive runoff of nutrients into area streams and lakes.

Almost all commercial fertilizers contain one or a combination of the following chemicals:

Nitrogen	(N)
Phosphorus	(P)
Potassium	(K)

Labels on fertilizer packaging usually provide the quantities of each of these three chemicals in the above order. Some of the plant available nutrients in common nitrogen fertilizers are as follows:

Anhydrous Ammonia	82% Nitrogen
Urea	45% Nitrogen
Ammonia Nitrate	33.5% Nitrogen
Liquid Nitrogen Solution	28-38% Nitrogen
Ammonia Sulfate	21% Nitrogen
Calcium Cynamide	21% Nitrogen
Calcium Nitrate	16% Nitrogen
Sodium Nitrate	16% Nitrogen
Urea-Formaldehyd	38% Nitrogen

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The fertilizers used in the 208 area were compiled through a data retrieval system applied in 1977. Although the results of that effort cannot be considered as a complete list of all the fertilizers used in the area, it did provide a basic list and most probably reflects the majority of fertilizer usage. In some instances, the trade names of chemical fertilizers were given, but in many cases only the N-P-K formula was given. The trade names listed were Fertilome, USS Fertilizer, Swiss Harvest King, Farm Service, US Steel, Scott Lawn, Garden Fertilizer, Hopcaid, and Swiss Fertilizers. Technical chemical names given were nitrogen phosphates, potash, ammonia, triple super phosphate, diammonium phosphate, urea, anhydrous ammonia, amonium nitrate, and various solutions of nitrogen (N) - Phosphorus (P) - Potassium (K) in the following percentages:

N - P - K
33½ - 0 - 0
0 - 0 - 60
18 - 46- 0
28 - 0 - 0
3 - 9 - 12
12 - 12- 12
40 - 10- 10

The Illinois Department of Agriculture reported that in 1976 fertilizer usage in the 10 county area, exclusive of limestone and manure, was 47,876 tons. The following table illustrates fertilizer tonnage by county for 1976:

Table 21
FERTILIZER TONNAGE BY COUNTY

	N	P	K	Totals
Franklin	2,430	1,511	1,814	5,755
Gallatin	5,259	3,473	3,734	12,476
Hamilton	1,598	1,530	1,690	4,818
Hardin	2	8	12	22
Jackson	2,110	1,163	1,851	5,124
Jefferson	1,740	2,048	2,300	6,088
Perry	1,203	1,136	1,368	3,707
Pope	120	192	168	480
Saline	3,381	2,519	2,527	8,427
Williamson	905	912	1,023	2,840
TOTAL	18,748	14,492	14,636	47,876

Source:
Unpublished Data, Illinois Department of Agriculture, 1976.

The next table indicates the relationship between cropland acres and fertilizer used for each county in the 208 area. It should be noted that the data for cropland are for 1974, while the data for fertilizer tonnages are for 1976.

Table 22
CROPLAND/FERTILIZER RELATIONSHIP

County	Cropland* (Acres)	Fertilizer** (Tons)	Average Tons Per Acre
Franklin	131,187	5,755	.044
Gallatin	123,369	12,476	.101
Hamilton	155,902	4,818	.031
Hardin	11,688	22	.002
Jackson	109,195	5,124	.047
Jefferson	154,058	6,088	.040
Perry	76,984	3,707	.048
Pope	41,972	480	.001
Saline	90,528	8,427	.093
Williamson	31,700	2,840	.090

* Illinois Agricultural Statistics, 1974 Illinois Cooperative Reporting Service, Illinois Dept. of Agriculture.

** Unpublished Data, Illinois Department of Agriculture, 1976.

Nutrient Pollution

The use of additional nutrients is an important factor in generating high yields of certain crops raised in the 208 area, particularly corn. The placing of additional nutrients in the soil does not necessarily cause pollution in streams and other surface or ground waters. However, excessive amounts of nutrients or the improper use and application of additional nutrients can result in water pollution. This pollution can accelerate the eutrophication process of lakes and threaten human health.

Once in the soil, nitrogen in the form of nitrate may be 1) absorbed by plants, 2) lost by leaching, 3) lost by erosion and surface water runoff, 4) lost as gases, and 5) retained in the soil. A host of biological, climatic, and soil factors influence what happens to the nitrogen. Data indicates that nitrate will leach through the soil and may enter water supplies if rates of fertilizer are added in excess.

The Illinois water quality standard for Ammonia Nitrogen is 1.50 mg. per liter; and the Public Water Supply Standard for Nitrate Nitrogen and Nitrite Nitrogen is 10 mg/l and 1 mg/l, respectively. There is no stream standard for Nitrate and Nitrite. There are 27 IEPA Sampling Stations in the Big Muddy River Basin and 24 IEPA Stations in the Saline - Ohio River Basin. The following tables indicate the location, year, and nitrogen constituent found in violation of the state criteria in the Big Muddy Basin and the Saline - Ohio River Basin respectively.

During the 1972 - 1973 period a total of fourteen sampling locations showed Ammonia Nitrogen concentrations above the acceptable limit. During the period 1974 - 1975 violations were reported at only the four following sites:

Sites of Violations for Ammonia Nitrogen 1974 - 1975

ND-03--I-57 Bridge, 1.5 miles south of Marion (Crab Orchard Creek)
NEB-01--Route 14 Bridge, 1 mile east of Old DuQuoin (Reese Creek)
NH-05--Route 37, Bridge 1 mile north of West Frankfort (Middle Fork-Big Muddy)
NJ-07--Route 37 Bridge, 3 miles south of Mt. Vernon (Casey Fork)

It should be emphasized that the above mentioned violations cannot necessarily be attributed to sources involving agricultural production. The proximity of the sites below municipal sewage treatment plant outfalls may reflect point-source impacts on the stream quality.

Table 23
BIG MUDDY BASIN
Nitrogen Violations

I.E.P.A. Station	1972	1973	1974	1975
ND-01	Ammonia N.	----	----	----
ND-03	Ammonia N.	Ammonia N.	Ammonia N.	Ammonia N.
NEB-01	Ammonia N.	Ammonia N.	Ammonia N.	----
NF-01	Ammonia N.	----	----	----
NGA-01	Ammonia N.	----	----	----
NH-05	Ammonia N.	Ammonia N.	Ammonia N.	----
NJ-07	Ammonia N.	Ammonia N.	----	Ammonia N.

Source: IEPA, Water Quality Network, 1973, Summary, Vol. 1 and Vol. 4

Table 24
SALINE-OHIO RIVER BASIN
Nitrogen Violations

I.E.P.A. Station	1972	1973	1974	1975
AT-04	Ammonia N.	----	----	----
AT-05	Ammonia N.	Ammonia N.	----	----
ATG-03	Ammonia N.	----	----	----
ATGX-01	Ammonia N.	Ammonia N.	----	----
ATH-01	Ammonia N.	Ammonia N.	----	----
ATH-05	Ammonia N.	----	----	----
ATHG-01	Ammonia N.	Ammonia N.	----	----

Source: IEPA, Water Quality Network, 1973, Summary, Vol. 1 and Vol. 4

Possible Pollution Control Mechanisms

After examining the potential threat to water quality in the 10 county area from excessive nutrient use, the area 208 Land Use - Agriculture Committee recommended the following Best Management Practices for use throughout the area.

In the area of soil testing for fertilizer type and quantity determination, the committee has recommended that farm operators:

1. Apply soil testing to determine the proper use and requirements of fertilizer.

2. Determine from soil testing a proper balance between calcium, potassium, and phosphorus.

3. Use only nutrients which are lacking from the soil.

4. Use soil test results to determine proper nutrient, liming, and fertilizer application.

5. Assure proper plant growth and minimize nutrient loss by practicing balanced fertilization and refraining from over fertilization.

The Committee further recommends that every farm operator have a soil test made at least once every four years. The results of these tests should be used in planning lime and fertilizer application programs to insure a proper balance of nutrients in the soil.

Soil Productivity Information and Soil Test Results

Combine soils test results with soils productivity information to determine nutrient needs in order to prevent excessive runoff and to reduce unnecessary nutrient runoff.

Utilization of Accepted Literature Standards

1. Use of levels of fertilizer application recommended in the Illinois Agronomy Handbook.

2. Application of nutrients, including manures and sludge, only in accordance with current recommendations by IEPA.

It is recommended that the following guidelines be considered for timing of fertilizer application.

1. The most efficient time to apply nitrogen is sidedress or time of planting. For non-nitrate forms a soil temperature of 50°F and cut 4" into the soil is recommended. Application at this time is not always feasible and often it is more convenient to apply nitrogen in the fall, with a minimal loss in production. Nitrogen materials containing free ammonia, such as anhydrous ammonia, are lost more easily than lowpressure solutions and should be placed in the soil to a depth of six to ten inches, depending on soil type.

2. Application of nitrification inhibitors should take place in order to reduce nitrogen loss when leaching and denitrification conditions appear to exist.

Areas Prohibited from Fertilizer Application

Do not apply fertilizers on barren soil where there is more than a 5' per 100' slope without proper incorporation, or on frozen soil.

Fertilizer Use on Special Soil Areas

Avoid excessive nutrient losses by incorporating proper fertilizer amounts, methods, and timing on sandy, organic, or poorly drained soil.

Crop Rotation

Rotation of crops to reduce nutrient loss potential; for example, a corn-soybean rotation reduces the nitrogen application required for corn.

Knowledge about Nutrient Disposal

Educational programs to inform plant operators, dealers, and

distributors about the dangers in dumping, leaks and spills; and proper disposal of fertilizers, chemicals, and containers should be developed and expanded by the University of Illinois Extension, Department of Agriculture, Illinois Environmental Protection Agency, and Soil and Water Conservation Districts.

Nutrient Research Programs

1. Research programs should be established to study losses of plant nutrients within a controlled watershed.

2. Research programs should further investigate the movement of phosphorus and nitrogen into area streams and lakes.

3. Investigation of other nutrient runoff factors should be conducted in conjunction with the University of Illinois Dixon Springs, Southern Illinois University, local Soil and Water Conservation Districts, and the Soil Conservation Service.

REFERENCE SOURCES FOR CHAPTER 3

Office of Research and Development, USEPA, 1975 Control of Water Pollution from Cropland, p. 35.

Illinois Cooperative Crop Reporting Service, Illinois Agricultural Statistics, 1974, p. 21, 1975.

Council of Environmental Quality, College of Agriculture, University of Illinois, Alberton Conference, 1971, Environmental Quality and Agriculture, p. 27-29.

IEPA, Water Quality Network, 1973, Summary, Vol. 4.

IEPA, Water Quality Network, 1973, Summary, Vol. 1.

Council of Environmental Quality, op. cit.

Chapter 4

PESTICIDE/HERBICIDE POLLUTION FROM AGRICULTURE

The use of pesticides and herbicides has become an integral component of modern agriculture. The elimination of unwanted insects, mites, weeds and grasses is considered a necessary step in order to achieve a high crop yield. The use of pesticides and herbicides is increasing both in terms of the number of varieties used as well as in absolute quantities.

Illinois is the third largest user of pesticides in the United States, ranking behind California and Iowa.[1] The 1976 Survey on Pesticide Use by Illinois Farmers indicates that in 1976 over 18.7 million acres of corn and soybeans in Illinois were treated with herbicides. This is an increase from 14.4 million acres reported treated in the prior survey conducted in 1972. Only one-half of the reported increase was attributable to an increase in harvested acreage.[2] The use of insecticides was steady during the same period with approximately 7.2 million acres treated. Over one-half of Illinois' corn acreage is treated. Soil insecticides for corn rootworm control account for the most acres treated and most pounds of insecticides used in Illinois.

Among the primary herbicides used with in the 208 area are Dacthal, Atrazine, Lasso, Larox, Sencor, Treflan, Amiben, Cobex, Eradicane, Premerge, Dinitro, Princep, Ramrod, Sertan, Baladex, Butoxone, Butyrac, Casoron, Latrex, Mow-down, Esteran, Roundup, and Tenoran. Pesticides used within the 208 area include Cyzon, Kelthane, Methoxyclor, Carboryl, Tedion, Furadan, Malithion, Diazenon, Basudin, Bamma-BHC, Marlate, Sevin, Spectracide, Actidione, Benlate, Dylox, and Supracide.

Pesticides will remain an important factor in Illinois agriculture because of the economic gain available to the food producer. An economic analysis of data from a 10-year experiment in Illinois indicates that the profitability of herbicide use is very high, ranging from $3.30 to $4.89 per $1.00 of herbicide cost. A break-even analysis indicates

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that the probability of financial loss is lower with herbicides than without them.[3] Estimated profit to Illinois farmers from insect control over and above treatment costs was 52.3 million dollars in 1976.[4]

As new pest control problems develop in the future, additional pesticides will be introduced into the area. Since 1964, five new insects pests (western corn rootworm, cereal leaf beetle, alfalfa weevil, horseradish weevil, and the soybean eating strain of the Mexican bean beetle) have either invaded or been discovered in Illinois, and several other insect pests, plant nematodes, and weeds have dispersed more widely in Illinois in the past 1-5 years. In 1977, practically all alfalfa south of I-70 was sprayed for the alfalfa weevil where virtually none was sprayed in that area 10 years ago.[5]

The Pollution Process

Pesticides may enter area streams by moving with sediment, water, or both. Whether it moves in runoff water or eroding sediment, transport depends primarily on water solubility of the chemical, the degree of adsorption on soil, and on the interaction of soil, pesticide, and water. The most important soil properties which influence the way a pesticide partitions between soil and water are the organic matter content, acidity, cation exchange capacity, moisture content, temperature, and clay-mineral content.[6] A majority of the primary pesticides are transported with sediment and water while relatively few are transported solely with water.

Insecticides are grouped into three major chemical groups: organochlorine insecticides, organophosphate insecticides and carbamate insecticides. As a class, organophosphate insecticides are among the least hazardous pesticides in the aquatic system because they hydrolyze rapidly. In most aquatic systems, most organophosphate insecticides hyrdolyze within 8-12 days with hydrolysis occurring in the water and on sediments. Carbamate insecticides will degrade in slightly alkaline water in less than four weeks. Organocholrine insecticides degrade slowly in aerobic aquatic systems, but decompose at a more rapid rate in anaerobic systems because of the action of micro-organisms. This degradation involves dechlorination of the molecule, takes several months to complete within a natural system, and persistence varies among individual insecticides.[7]

Residues from certain insecticides (primarily organochlorine varieties) tend to accumulate in aquatic life and can reach hazardous levels. Pesticides are generally used during a few weeks in the spring. Further, some pesticides are applied to the soil immediately prior to rainfall, increasing the probability of a significant level of runoff. Stream contamination may also result from the improper handling of used pesticide containers and dilute rinsate water from sprayers.

The apple and peach orchards within the 10-county area are an additional source of potential pesticide pollution. Although orchard acreage is small compared to acreage within the area used as cropland, in orchards the use of pesticides is intensive. The inorganic pesticides that had been used by orchardist consists mainly of arsenic, lead, copper, zinc, and mercury. These are virtually non-degradable and their translocation is most often initiated by soil movement. In the orchards of the area, continuous sod cover is commonly practiced. This sod cover effectively reduces the possibility of excessive soil erosion from these parcels.

Residues from pesticides used in area orchards, including DDT, remain in the top soil for several years. High concentrations of DDT are still a serious problem despite the fact that it has not been used for several years. These high levels of DDT in established orchards may contaminate surface waters if the land is converted to cropland because of the greater probability that erosion will carry the DDT into area streams.

Pesticide Use in the 208 Area

In order to better determine the extent of pesticide use in the 208 area and to identify specific pesticides being used in the area, a survey was conducted of commercial outlets of agricultural products in the area. The results of the survey cannot be considered as describing in definitive terms the total use of pesticides within the area, but has provided a basic list of commercial pesticides being sold and used in the area and did provide an indication of total quantity.

Survey forms were prepared and transmitted to 100 identified commercial outlets of pesticides, herbicides, fertilizers, and limestone. The response rate of the survey was just over 33 percent. However, it is estimated that 15 to 20 percent of those originally surveyed are not actual sales outlets. Maps returned with the survey data indicate that most sales outlets within the 208 area have market areas extending

beyond the 10-county area. As much as 50 percent of the sales of outlets responding to the survey may have been for use outside of the 208 area. Control totals for pesticides use were unavailable from other sources. Therefore, estimates of total pesticides use in the 208 area can only be considered a rough estimate drived from what is probably a large range.

The results of the survey are summarized in the following tables for herbicides and pesticides. Information contained in the tables include a listing of the trade or common names of reported herbicides and pesticides respectively; their reported sales area, their basic chemical classification, the mode by which they are predominantly transported, their toxicity and their approximate persistence in soil (for herbicides only). The following are listings of abbreviations used in the tables and more detailed explanations of column headings.

Sales Area--indicates the number of counties within the 208 area for which sales were reported.

Chemical Class--each of the pesticides and herbicides reported sold in the 208 area have been placed in a basic chemical class. Thirteen classes for herbicides and three for pesticides are listed below, along with their abbreviations:

Herbicides

AL = Aliphatic acids
AM = Amides and Anilides
AR = Aromatic acids and Esters
AS = Arsenicals
CB = Carbamates and Thiocarbonmates
CT = Cationics
DZ = Diazines
NA = Nitroanilines
NT = Nitriles
PH = Phenols and Dicarbonylic acids
TZ = Triazines and Trizoles
UR = Ureas

Pesticides

CB = Carbamates
OCL = Organochlorines
OP = Organophosphorus compounds

Predominant Transport Modes--refers to the manner in which chemicals in pesticides and herbicides are likely to enter streams. The types of movement are abbreviated as follows:

S = Those chemicals which will move predominantly with sediment;
W = Those chemicals which will move predominantly with water;
SW = Those chemicals which will move in significant amounts with both sediment and water;
U = Those chemicals whose predominant mode of transportation is unknown.

Toxicity--is divided into two categories and expresses the lethal dose or lethal concentration to 50 percent of the test animals and is listed as LD_{50} and LC_{50} respectively. Footnotes to the tables describe in greater detail the manner in which toxicity is derived for some of the chemicals.

Persistence in soil--refers to the persistence of the particular herbicide in the soil expressed in number of days.

Possible Pollution Control Mechanisms

The Pesticide Subcommittee of the Illinois Agricultural Task Force on Non-Point Sources of Pollution made the following recommendations in their Best Management Practice Report:

> The Illinois Interagency Committee on Use of Pesticides appoint a permanent Illinois Pesticide Monitoring Advisory Board to establish and supervise a State Pesticide Monitoring Program. The Board will report its findings and recommendations annually to the Interagency Committee on Use of Pesticides. The State Pesticide Monitoring Program will include the following activities:

Table 25
PESTICIDES: AREA, CLASS, MODE, TOXICITY, PERSISTENCE

Pesticides - Common or Trade Names	Sales Area Number of Counties	Chemical Class[1]	Predominant Transport Mode[2]	Toxicity	
				Rat, Acute Oral LD_{50}, mg/Kg[3]	Fish[4], LC_{50}, mg/Kg
Basudin[5,6]	4	OP	SW	76	0.030
Carbaryl	5	CB	SW	500	1.0
Cygon	4	OP	W	185	9.6
Diazenon[5,6]	1	OP	SW	76	0.030
Dylox	1	OP	W	275	0.16
Furadan[5]	9	CB	W	8	0.21
Gamma-BCH	4	OCL	S	88	0.018
Kelthane[6]	4	OCL	S	684	0.10
Malathion	2	OP	W	480	0.019
Marlate	4	OCL	S	5000	0.007
Methoxychlor	5	OCL	S	5000	0.007
Sevin	7	CB	SW	500	1.0
Spectracide	7	OP	SW	76	0.030
Supracide[5,6]	7	OP	U	25	
Tedion	4	OCL	SW	14000	1.10

[1]See paragraphs before table.
[2]See paragraphs before table.
[3]See paragraphs before table.
[4]48 or 96 hour LC_{50} for bluegills or rainbow trout, unless otherwise specified.
[5]Registered as both insecticide and herbicide.
[6]No common name exists.

Source: Greater Egypt Regional Planning and Development Commission, 208 Research Survey and U.S.E.P.A., Office of Research and Development, Control of Water Pollution from Cropland, Vol. 1, 1975, pp. 48-52.

Table 26
HERBICIDES: AREA, CLASS, MODE, TOXICITY, PERSISTENCE

Herbicides - Common or Trade Names	Sales Area Number of Counties	Chemical Class[1]	Predominant Transport Mode[2]	Toxicity: Rat, Acute Oral LD_{50} mg/Kg[3]	Toxicity: Fish[4], LC_{50}, mg/Kg	Approximate Persistence in Soil, Days
Atrex	9	TZ	SW	3080	12.6	300-500
Amiben	9	AR	W	3500	[5]7.0	40-60
Atrazine	4	TZ	SW	3080	12.6	300-500
Baladex	1	TZ	SW	334	4.9	
Butoxone	4	PO	S	300	4.0	
Butyrac	7	PO	S	300	4.0	
Casoron	4	NT	S	3160	10-20	60-180
Cobex	2	NA	S	3000	6.7	90-120
2,4-D/Ester	1	PO	S	500-875	[6]4.5	
Dacthal	7	AR	S	3000	> 500	400
Dowpan	7	AL	W	6590	> 100	15-30
Eradicane	10	CP	SW	1360	19.0	30
Lasso	10	AM	SW	1200	2.3	40-70
Lorox	10	UR	S	1500	16.0	120
Modown	1	AR	S	4600	1.8	40-60
Premerge	2	PH	SW	5	[6,7]0.4	15-30
Princep	10	TZ	S	5000	5.0	200-400
Ramrod	9	AM	W	710	1.3	30-50
Roundup	7	AL	S	4320	Low tox.	150
Sencor	10	TZ	W	1930	> 100	150-200
Sutan	2	CB	S	4500	4.2	40-80
Tenoran	7	UR	S	3700	> 15	[6]300-400
Treflan	10	NA	S	3700	[5]0.1	120-180

[1]See paragraphs before table.
[2]See paragraphs before table.
[3]See paragraphs before table.
[4]48 on 96 hour LC_{50} for bluegille or rainbow trout, unless otherwise specified.
[5]24 hour LC_{50}.
[6]For killifish.
[7]For goldfish.
[8]Trade name; no corresponding common name exists.

Source: Greater Egypt Regional Planning and Development Commission, 208 Research Survey and U.S.E.P.A. Office of Research and Development, Control of Water Pollution from Cropland, Vol. 1, 1975, pp. 48-52.

(a) Systematic monitoring for pesticides in water, sediment, and in fish and other appropriate indicator organisms to detect seasonal and/or annual levels of pesticide residues in the aquatic envirnomental in Illinois.

(b) Evaluation of all pesticides used in Illinois in the Metcalf laboratory model aquatic ecosystem to identify those compounds with potential for persistence and biomagnification in the aquatic environment.

(c) Annual Survey of Illinois Pesticide Use in agriculture.

(d) Annual benefit/loss analysis on pests and pesticides in Illinois agriculture.[8]

The members of the area 208 Land Use - Agriculture Committee agreed that the above recommendation of the statewide task force was applicable and appropriate for the 10-county area and included it among their own recommendations. The Metcalf Model Ecosystem referred to in the recommendation "consists of a 20-gallon aquarium with a sloping shelf of washed quartz sand entering a lake of seven liters of standard reference water which provides mineral nutrition for plankton, algae, snails, mosquito larva, and fish and for sorghum plants growing on the terrestrial phase of the system. The water phase is aerated and the entire system is kept in an environmental growth chamber. The radio-labelled pesticide is applied to sorghum plants or to the soil of the system using a realistic dosage of 1-5 mg. per experiment equivalent to 0.2-1.0 pound of actual toxicant per acre. Ten saltmarsh caterpillars are introduced to consume the treated sorghum plants and the caterpillars and their excretory products, leaf, grass, etc., contaminate the lake portion of the model. The movement of the radio-labelled products from plants to lake is measured by counting the radioactivity at intervals of 1, 2, 4, 7, 14, 21, 28, and 33 days."[9]

The area committee made the following recommendations on the subjects of pollution from used pesticide containers and dilute rinsate water from sprayers. These topics were discussed at the State level, but their consideration by the State committee was postponed.

In order that pollution from used pesticide containers by significantly reduced or eliminated, the area committee made the following recommendations:

Pesticide containers should be triple-rinsed and disposed of at an approved sanitary landfill.

Sanitary landfill operators should not accept containers that are not triple-rinsed without a special permit.

Educational programs on triple-rinsing should be established and maintained.

Regulations to assure rinsing and puncturing of pesticide containers should be developed.

Commercial pesticide operators should employ large rinsing and puncturing pesticide container washing units.

Commercial pesticide operators should also employ large can crushing units and recycling practices.

Systems should be developed for recycling pesticide containers.

In the area of stream contamination from dilute rinsate water from sprayers the committee recommended:

Use of a chemical volume control system where practical, by the adaptation of a two-pipe system to the central spray boom spray nozzles which automatically perform chemical volume control of dilute rinsate waters.

In this type of spraying system "there are two pumps, one for the water and the other for the comparatively small volume of chemical concentrate. The chemical pump is ground-wheel driven because it meters out small quantities and the output of concentrated chemical would be directly proportional to the forward speed. Use of chemical volume control would completely eliminate the problem of disposal of remaining dilute rinsate water from sprayers since the water in the tank contains no pesticide. The system has been patented, but not commercially developed for agricultural field sprayers. Existing sprayers could probably be readily adapted to the volume-control technique and it is likely that once these units are commercially available, they will be readily adopted by commercial applicators and farmers."[10]

Concerned by loss of pesticides by various processes including application, volatilization, sorption, leaching, and chemical and biological degradation, the committee made the following general recommendations:

Improved erosion/sedimentation control measures by all farm operators.

The committee endorsed the use of economic incentives to assist in the reduction of soil erosion and pesticide transport in the following recommendations:

Use of seriously eroded land for permanent crops, woodland, pasture, or perennial legumes.

Initiation of supplemental federal and/or state grant programs.

The committee noted that the U.S.D.A. Agricultural Conservation Program was inadequate to meet the need to reduce erosion, sedimentation, and pesticide transport.

The committee also recommended action for additional work involving research and education on pest control and crop production. The committee expressed that there is inadequate encouragement and support by the State of Illinois for pest management research which focuses on integrating pest control and crop production. The area committee recommended the:

Implementation of long range grant-in-aid programs to reduce water pollution from pesticides, including selection criteria for pest control actions and emphasizing alternate controls, use of minimum pesticide dosages, and the integration of proper chemical controls with other control factors.

FOOTNOTES FOR CHAPTER 4

[1]Task Force on Agriculture Non-Point Sources of Pollution, Best Management Practices, 1977, p. 59

[2]James R. Kendall, Pesticide Use by Illinois Farmers, 1976. (Cited in Best Management Practices Report).

[3]D. E. Hawkins, et al., Economic Analysis of Herbicide Use in Various Crop Sequences; Illinois Agricultural Economics, January, 1977. (Cited in Best Management Practices Report).

[4]J. L. Wedberg and D. L. Black, Insect Situation and Outlook and Insecticide Usage, 29th Illinois Custom Spray Operators Training School, Cooperative Extension Service, University of Illinois, 1977 (Cited in Best Management Practices Report).

[5]Task Force on Agriculture Non-Point Sources of Pollution, Best Management Management Practices Report, 1977, p. 76.

[6]Ibid, p. 73

[7]Ibid, p. 63.

[8]Ibid, pp. 61-62

[9]Ibid, p. 68.

[10]Ibid, p. 72.

Chapter 5

LIVESTOCK WASTES AS POLLUTION SOURCES

Water pollution may result from animal wastes from either a feedlot or pasture setting. Feedlots represent the operation of greatest concern because the higher density of the animal population produces large amounts of wastes within a small area which must be handled properly. Improper waste handling can result in runoff of sufficiently high levels of pollutants into streams to contaminate water supplies and to destroy aquatic life.

It should be noted that there are few large feedlot operations within the ten-county 208 area. In terms of total animal production, the raising of livestock in pasture settings is responsible for the majority of animal wastes. While the lower livestock densities in pastures pose a less severe threat to the water quality of a particular stream than would a feedlot, the raising of livestock on pasture land still represents a potential detriment to overall water quality within the region.

Feedlots

Feedlot is a term commonly used to describe a type of livestock raising operation wherein the animals are kept in confinement within a limited area. In most instances, the total feed and water needs of the animals are provided for within the feedlot setting, completely eliminating the need for the animal to graze. Feedlots are often finishing operations where animals are confined for the final weeks or months prior to slaughter. However, confinement operations also may encompass the total life cycle of the animal.

Small feedlots facilities do not require a permit unless the Illinois Environmental Protection Agency determines that the facility violates or threatens to violate the Illinois Environment Protection Act. Large feedlot operations do require a National Pollution Discharge Elimination System (NPDES) permit. IEPA lists the following factors as determining the need for a permit:

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1) Kinds of and number of livestock;
2) Presence or absence of livestock waste-handling equipment or facilities, or both;
3) Distance to structure occupied by humans;
4) Soil type, with special emphasis on characteristics such as permeability;
5) Slope of land or the time for waste to seep into the soil;
6) Use of land between facility and stream or other surface waters;
7) Distance to stream or other surface waters or presence of surface water in the facility;
8) Location of facility with respect to floodplain;
9) Thickness, texture, and permeability of earth material between the land surface and shallow water-bearing formations underlying or adjacent to the facility.[1]

The most basic form of feedlot is an open or uncovered feedlot. Livestock are kept in an area, usually unpaved, and often with only minimal housing. Manure is scraped from the lot at extended intervals ranging from once every three months to only once a year, and spread directly over land or stockpiled for spreading at a later date. Open feedlots are subject to runoff from rain, snowmelt and water leakage.

Covered confinement feedlots prevent rainfall runoff and may contain solid floors or slotted floors. If a solid floor is utilized, bedding is usually provided for the livestock. The bedding and solid manure absorb liquid wastes and the total waste product is handled as a solid.

Covered confinement facilities with slotted floors allow for manure to be handled as a liquid. Some systems provide for wastes to drop directly into storage pits while others are equipped with gutters below the slotted floor which must be flushed periodically.

Feedlot Locations and Activity in the 208 Area

Three known concentrated livestock feeding operations are within the ten-county 208 area. Two of the three operations required permits. One of those which had obtained a permit was forced to cease operations in the spring of 1977 by I.E.P.A. A fourth feedlot operation is expected to open within one year.

The Knox-Hirons Livestock Facility is a feedlot operation located near Waltonville in Jefferson County. It's capacity ranged from 1200 to 1500 head of hogs. The facility was issued discharge permit number N081-06. The facility was forced to close because of its inability to meet the state pollution control standards.

The Gypsy Hill Farm, Inc. is a livestock facility operated in conjunction with the DuQuoin Packing Company. The facility is located approximately one mile northeast of the City of DuQuoin in Perry County. This facility is the only feedlot operation within the 208 area which falls within the EPA feedlot point source category and requires a NPDES permit (#NED 145-8). The facility has a capacity of 4,500 beef cattle, of which approximately 35% are housed under roof (half of which has a liquid manure system). The drainage area consists of 40 acres. The runoff drains into three settling ponds and subsequently into a storage lagoon five feet deep which covers eight acres. A total of 240 acres is available for final disposition. Discharge from this facility into Reese Creek should only occur in the event of a 25 year, 24 hour rain of 5.6 inches per 24 hours.

The Keith Deal Livestock and Poultry Facility is located near Galatia in Saline County. Although it is one of the largest operations within the ten-county area, it is not of sufficient size to require a NPDES permit. The facility houses 25,000 chickens and approximately 75 hogs. The waste from the chickens flows into a pit, feedlot runoff flows into a lagoon. Wastes are ultimately spread over land.

A new feedlot facility is under construction north of Ridgway and is scheduled to begin operation within one year. It is anticipated that the facility will house 15,000 hogs at a time and will require a NPDES permit.

Future Feedlot Activity

Future feedlot activity within the 208 area is primarily dependent on factors external to the area. Although the decision to establish a feedlot is likely to be made by an individual within the area, overall market demand for livestock products and the ratio of the price of feed to the price of finished livestock will determine whether a new operation is likely to succeed.

The Illinois Department of Agriculture reports increases in both grain and pasture fed cattle and calves from 1970 to 1974. The percentage of cattle and calves which were grain fed declined over the period.

It is probable that feedlot operations will continue and expand within the ten-county area in the future. The extent to which this trend will manifest itself in the form of new and enlarged feedlot operations within the 208 area is difficult to project. The greatest threat to water pollution may come from smaller operations not requiring permits. Particular problems may arise from operations without disposal facilities and those whose operations have grown beyond the capability of their disposal system to properly handle wastes.

Impacts on Water Quality

Feedlot operations are designed to raise large numbers of animals within a small confined area. This increase in livestock density produces a corresponding increase in animal wastes within that limited area. This accumulation of animal waste is greater than the soil's ability to absorb and assimilate it safely. In order to prevent water pollution from these concentrated wastes, waste collection and disposal systems need to be initiated. Animal wastes need to be collected and stored in a manner which prevents runoff and leachage until the waste is properly spread and incorporated into a sufficiently large area of land.

It has been found that soil below feedlots contained 2,240 kg of nitrate nitrogen/hectare (2000 lb/acre), while the nitrate nitrogen in the surface soil on adjoining acres ranged from 58 to 168 kg/hectare (50 to 150 lb/acre). Contamination remains after an area is abandoned from livestock use. Barnyards, feedlots, and manure piles are sources of excessive nitrate nitrogen. Increased levels of atmospheric ammonia near feedlots may also contribute to higher levels of nitrogen in surface waters in the immediate vicinity. Groundwater under feedlots frequently contains ammonia and organic carbon. Runoff from feedlots also may contain high levels of salt and fecal coliforms.

The Knox-Hirons Livestock Facility had a capacity of from 1200 to 1500 hogs. The hogs were in closed confinement on a slotted floor which drained to a holding lagoon. Effluent was discharged from the holding lagoon. The following table indicates samples of effluent taken during two periods of overflow:

Table 27
KNOX-HIRONS LIVESTOCK FACILITY
January 8, 1973

	At Property Line	600 Feet Downstream	½ Mile Downstream
Coliform	1,100,000	2,300,000	None
NH_4	303	400	None
TSS	None	None	None
BOD	2,400	2,500	None

November 21, 1973

	At Property Line	600 Feet Downstream	½ Mile Downstream
Coliform	1,700,000	1,700,000	1,700,000
NH_4	1,200	400	120
TSS	12,000	1,500	400
BOD	22,000	2,700	560

Source: Unpublished IEPA Data.

As was previously mentioned, the raising of livestock on pasture is an important part of the agricultural production in the 208 area. Although animal wastes are not as concentrated as in a feedlot operation, these wastes are a potential source of stream contamination.

> The use of pastures and ranges is a major component of livestock production. Feeder calves are produced almost exclusively from cow-calf enterprises on pasture and range systems. A substantial portion of hog production is a pasture operation, handled portable facilities and mobile equipment. Most dairy farms ... use pasture when seasonal conditions permit... sheep production is also mainly a range and pasture operation...
>
> In pasture production, manure is deposited directly on the land by the grazing animals. Even though a relatively large land area may be available to animals on pasture, they tend to concentrate around feeding, watering, and resting sites.
>
> Concentration of wastes at these sites can be quite high, creating potential water pollution. Good drainage around these sites is essential, but may increase the possibility of contaminated runoff. Flowing streams also attract animals, particularly in hot weather, which can lead to contamination of water.[2]

Mechanisms Available to Control Animal Waste Pollution

The Livestock Waste Subcommittee of the Illinois Task Force on Agricultural Non-Point Sources of Pollution compiled Best Management Practices (BMP's) which address specific problems of properly collecting and disposing of animal wastes. These BMP's are intended for use by individual livestock operators, and when followed should effectively reduce the pollution from livestock facilities into area waters. The BMP's have been grouped by their applicability to specific types of livestock operations. The following were extracted from the Best Management Practices Report published by the Task Force in October, 1977 and were reviewed and accepted by the area 208 Land Use and Agriculture Committee.

Land Application of Livestock Wastes

1. Livestock waste application should not exceed the agronomic nitrogen rate, which is defined as the annual application rate of nitrogen that can be expected to be required for a reasonable anticipated crop yield.

2. The soil loss tolerance should not be exceeded on soils receiving livestock waste. Surface application may be used when the land slope is no greater than 5 percent or when the yearly average soil loss is less than 5 tons per acre (regardless of slope) as determined by the Universal Soil Loss Equation. Injection or surface application with immediate incorporation should be used when the land slope is greater than 5 percent and the yearly average soil loss is greater than 5 tons/acre.

3. Waste application on frozen or snow-covered land should be avoided. If wastes are spread on frozen or snow-covered land, such application should be limited to land areas on which the land slopes are 5 percent or less or adequate erosion control practices exist.

4. Livestock waste should not be applied within 150 feet of any water wall.

5. Livestock waste should not be applied on a floodplain that is subject to flooding once in ten years or oftener unless injection or immediate incorporation is used.

6. Livestock waste should not be applied in waterways.

7. The rate of application of livestock waste should not cause surface runoff. Livestock waste should not be applied during or immediately after a rain or to a saturated soil.

8. Livestock waste should not be applied within 200 feet of surface water unless the water is upgrade or there is adequate diking.

Covered Confinement, Solid Floor Facilities

9. Provide adquate solid manure storage so land application can be done when conditions are favorable.

10. Control runoff from uncovered manure storage areas.

11. Do not construct storage areas in coarse sands or gravels or in close proximity to fractured bedrock unless some type of effective sealing method is used.

12. Temporary manure stack shall be constructed or established and maintained in a manner to prevent runoff and leachate from entering surface or groundwaters.

13. No temporary manure stack shall be constructed within 100 feet of a water well.

Covered Confinement, Liquid Manure Storage

14. Provide adequate liquid manure storage capacity and management so that overflow does not occur and hauling during unsatisfactory conditions is unnecessary.

Covered Confinement, Flushing Gutter

15. Pump lagoon effluent as necessary onto cropland to prevent lagoon overflow.

16. Follow commonly recommended practices for lagoon management, including adequate dilution, minimum capacity, etc.

Open (Uncovered) Feedlots

17. To minimize the amount of water to be handled by a runoff control system, when possible, use diversions, channels, and roof gutters to keep unpolluted outside surface wastes from entering the lot.

18. Where necessary, prevent discharge of feedlot runoff by collecting and directing it through a runoff control of the type discussed in the preceding paragraphs.

19. Solid manure from lot surfaces, settling basins and stored runoff in holding ponds should be applied to land using recommended BMP's for land application.

Pasture Production

20. Maintain an animal stocking density that will not overtax the vegetation under normal conditions. Weather conditions, pasture types, topography of pastures, seasons and management practices would affect the animal:acre ratio. A good vegetative cover should be maintained to control runoff and prevent erosion.

21. Pasture rotation should be practiced to prevent overgrazing and destruction of the grazing areas. This would likewise reduce eroding of soil.

22. Locate feeding stations, salt licks, and alternate water supplies and plan for shading (natural or constructed) reasonable distances from streams and watercourses. Movement of feeders and waterers should be practiced to prevent grass losses near these structures.

23. Follow good pasture fertilization and make use of soil tests to maintain good vegetative cover.

24. Uniform spreading of animal wastes by mechanical means should be practiced. This would not only prevent rejection of polluted grasses by the animals, but would speed up decomposition of the wastes and thus minimize solids runoff if heavy rainfall should occur.

25. Make use of fences along streams where practical. Where the situation warrants, fence to provide limited access for watering. Downstream water use should be considered when deciding feasibility of stream fencing.

26. Where possible, new pastures and new operations should be planned in order that direct access of any waters would not take place. Pastures should be deliberately separated from such waters or else should be fenced along the streams. This would then require pumps and waterers to move water from the stream to the animals.

27. Provide farm operators informational programs relating to pollutional problems resulting from the direct access of animals to streams.

Milkhouse and Milking Parlor Wastes

28. Where possible, adapt facilities so milking center wastes are stored and handled together with other manure, either liquid manure or lot runoff.

29. Where necessary, provide separate storage and handling facilities for milking center wastes, ultimately applying them to land.

Silage Leachate

30. Store at the proper moisture content. Corn silage should be put up when the moisture content is about 65 percent (wet basis) or less, thereby decreasing the potential for producing leachate. For improvement of feed quality and other reasons, the present trend is to ensile corn at a lower moisture content than was typical ten or twenty years ago. When done at the proper moisture content, the natural corn ensiling process produces very little or no leachate. The same is true for haylage, especially since it is usually ensiled in an even drier state.

31. Use judicious site selection for silos. New silos, particularly trench or bunker silos, should be located away from surface waters, underground springs, or highly permeable soil formations. Areas with high groundwater conditions should be avoided as sites for trench and bunker silos.

32. Seal silo bottoms. Silo floors should be effectively sealed so as to minimize the possibility of groundwater pollution. In many cases, sealing can be accomplished with the use of clay soils found in the area. Silos can also be sealed by using plastic liners or bentonite clay, or by paving the silo floor.

33. Divert surface runoff. All surface runoff should be diverted away from trench and bunker silos. This could probably most easily be done by using earthen diversions.

34. Collect and properly dispose leachate which occurs. Any silage leachate that is produced should be directed to some type of collection device, such as a simple pit or small lagoon. The leachate should then be applied to cropland, by gravity drainage if possible. The pit could also be dewatered using a simple irrigation system or a liquid manure wagon, depending on the volume of liquid to be handled. As an alternative, the leachate could be directed to a feedlot runoff control system or liquid manure system associated with the livestock enterprise.

Poultry Watering and Egg Processing

35. Whenever possible, cup waterers should be used instead of a continuous-flow watering system. Properly functioning cups virtually eliminate the production of wastewater from the poultry watering system.

36. Minimize the amount of overflow water from continuous-flow systems. If a continuous-flow system is utilized, the watering troughs and flow rates should be adjusted so as to minimize the amount of overflow water. By reducing the volume of wastewater to be handled, the disposal problem is simplified.

37. Use an acceptable means of disposal. Wastewaters generated from poultry watering or egg processing systems should be disposed of in an acceptable manner. Means of disposal might include: lagooning and land application, vegetative filter systems, and septic tank seepage field systems. The septic tank and seepage field alternative would be feasible only for relatively small wastewater volumes. There are resource personnel and available references with design information on these disposal systems.

FOOTNOTES FOR CHAPTER 5

[1] IEPA, Water Quality Control Regulations, Feedlots, Chapter 5.

[2] USEPA, Methods and Practices for Controlling Water Pollution from Agricultural Non Point Sources. (EPA 430/9-73-015), 1973, pp. pp. 53-57

Chapter 6

MANAGEMENT: PRIORITIES, FUNCTIONS, AND INSTITUTIONAL STRUCTURE

Under Section 208 (c) of the Act, all agencies which are responsible for carrying out any portion of the Water Quality Management Plan must be designated as management agencies. Prior to designation, it must first be ascertained that a water quality problem exists; that there is an identification, if appropriate, of agriculturally related nonpoint sources of pollution; and the procedures and methods (best management practices) be set forth which may, to the extent feasible, control such sources.

In order to understand the rationale of the proposed agricultural nonpoint source management program, a brief summary of the problem assessment and areawide water quality planning priorities is given below. It should be noted that the Best Management Practices for various pollutant sources is contained elsewhere in this document.

Problem Assessment

Previous chapters of the report addressed erosion, nutrient runoff, pesticide/herbicide, and livestock wastes as the four major categories of pollutant sources resulting from agricultural practices which may impact water quality within the 208 area. Varying levels of impacts on water quality from these sources have been documented in a number of studies performed elsewhere in the nation.

Within the 208 area, no clear linkage has been established through an analysis of agricultural practices and available water quality data. However, the lack of substantive data directly linking pollutants to agriculturally related practices may be attributable to the improper location of monitoring sites and an insufficient data base rather than an absence of pollution.

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Traditionally, water quality monitoring stations were located in order to assess the impacts of municipal sewage treatment plant effluent or mine drainage rather than agricultural activities. An evaluation of recorded water quality data indicates that about 10 of the 48 listed parameters are analyzed per sample monthly. Analysis for determining the presence of the remaining parameters may occur 1 to 4 times per year.[1]

There does exist a sufficient basis to support the need for a process to control and manage these pollutant sources. The Land Use - Agriculture Committee supports the assumption that excessive rates of soil loss (displacement) from the land impacts water quality despite the absence of direct relationships between stream loadings and erosion losses. Accumulation of sediments within a number of the area's existing reservoirs is documented in other reports.[2,3] Erosion constitutes the most significant source of pollution as a result of agricultural practices.

The overall rate of nutrient application (N, P, K) per cropland acre appears to be low. However, comparison of specific crop acreages and fertilizer (tons) application indicate that the rate of application per acre per crop type approximates the rates recommended by the Illinois Agronomy Handbook 1977-1978. Under certain conditions, the probability for nutrient runoff exists within the 208 area.

Pesticide/herbicide application within the 208 area constitutes a third category of concern. In that most pesticides are attached to soil particles and are water translocated to streams, erosion control systems constitute a principle component of the management system.

Livestock wastes pose the most serious hazard where densities are large and are in confined feeding quarters. In view of the existing regulatory program concerning feedlot operations, the principal issues concern the small unregulated feedlot operation and pasture management.

In summary, erosion is identified as the primary problem requiring management systems. Secondary benefits of control would be the significant reduction of pesticide/herbicide elements attached to soil particles which may be water translocated to the area's streams and lakes. Erosion control measures also include surface water management mechanisms which may result in partial control of nutrient runoff. Cropland erosion is the most critical source of pollutants within this category.

Water Quality Priorities

1. The areawide program concern is with water quality. The primary problems impacting water quality are mine drainage, municipal wastewater sources, and agricultural nonpoint sources especially as they affect water supply lakes.

Over 85% of the area's population is dependent on surface water supplies. Previous capital construction outlays through a combination of federal, state, and local tax dollars resulted in the development of Rend Lake, Cedar Lake, and Kinkaid Lake. These three lakes are the water supplies for approximately 70% of the area population. Other surface water supply sources are the Marion reservoir; Harrisburg reservoir and side channel impoundment; Lake of Egypt; Pinckneyville reservoir; and the Eldorado reservoir.

The first priority of concern is the protection of these reservoirs from point and nonpoint sources of pollution. The impact of erosion as a source pollutant has been previously noted. Consequently, the implementation of erosion control measures, in the watersheds of these reservoirs constitutes the first and principal management system priority within the agricultural nonpoint source area.

2. The second priority for erosion control management systems is the protection of those lakes which constitute primary recreational facilities as well as secondary, or back-up water supplies. Lakes in this category include the watersheds of Crab Orchard Lake, the two West Frankfort lakes, the Mt. Vernon reservoir, and the DuQuoin reservoir.

3. The third priority area of concern is the preservation and improvement of year-round flowing streams, and those streams currently possessing relatively high water quality. These include Lusk Creek, Big Grande Pierre Creek, parts of the North Fork of the Saline, and parts of the Middle Fork of the Big Muddy.

4. The fourth ranking prioity addresses locally severe erosion problem areas impacting year-round flowing streams.

Management Agencies*

Agriculturally related management agencies must have sufficient authority to control the nonpoint source problem. Section 208 (c)(2) of P.L. 92-500 lists a number of authorities which must be possessed by designated management agencies. Of these, the following appear applicable to nonpoint source management agencies.

1) Authority to carry out appropriate portions of the areawide water quality management plan;

2) To effectively manage its assigned responsibilities of the plan;

3) Directly, or by contract, design appropriate facilities and works, and to operate and maintain new and existing facilities or works;

4) To accept and utilize grants or other funds from any source;

5) To raise revenues;

6) To incur long- and short-term indebtedness; and

7) To assure implementation of an areawide water quality management plan that each participating community (or cooperation) pays its proportionate share of costs.

Further authorities are required should a regulatory program rather than a general oversight, or voluntary program be instituted. Regardless, one of the more significant requirements refers to the designated agency's capability in that it must "have in existence the legal, financial, managerial, and institutional capability to carry out its assigned responsibilities."[4]

Based on a review of the state enabling legislation, the area's county soil and water conservation districts possess the necessary requirements

*For more detailed analysis of the management agencies and their duties, see the Management Strategy Report, Chapter 1, and the "Plan Summary" document under the section on Agriculture.

to be designated as management agencies. Consequently, each of the area's soil and water conservation districts are recommended for designation as management agencies with respect to erosion control programs within the priority areas outlined in the previous section.

The basic rationale is that 208 management responsibilities are directed toward improving water quality rather than soil productivity. It is imperative that the priority areas be addressed in at least the first five years of the program. These are the same areas that must show progressive stages of improvement in order to maintain management agency designation from year to year. To do otherwise may seriously dilute the effectiveness and success of the management agency.

For purposes of achieving the abatement of agricultural pollution within the designated priority areas, the following participation rates by landowners of critical erosion areas are recommended:

1979 - 1- 5%	1981 - 10-20%	1983 - 33-50%
1980 - 5-10%	1982 - 20-33%	

In addition, it is proposed that the county soil and water conservation districts be responsible for ensuring that:

1) educational programs be established to inform the affected population of best management practices with regard to fertilizer, pesticide/herbicides, and livestock wastes;

2) technical and financial assistance be furnished to eligible populations with respect to the four categories of agricultural nonpoint sources of pollutants;

3) memorandums of agreement be enacted with the County Cooperative Extension Service to prepare and conduct the educational programs; and

4) memorandums of agreement be enacted with the County ASCS Committee to mutally define specific levels of assistance and specifically allocate funds to support implementation of cost-eligible best management practices in the priority areas.

Erosion and Sediment Control Programs

As part of its management agency responsibility, each county soil and water conservation district will, within the first year of designation, re-evaluate its annual work program with respect to the priority areas, and begin an assessment of problem lands within the priority areas to assist in the development of specific BMP's which are applicable. In addition, it is recommended that each county soil and water conservation district begin the development of its countywide erosion and sediment control program as authorized by PA 80-159, passed by the Illinois General Assembly in 1977.

The following constitute the initial management responsibilities for the respective soil and water conservation districts. These areas of concentration may change in the course of annual plan updates and review. However, the intention of the geographical area concentration is twofold: (1) it addresses the water quality priorities; and (2) it permits the soil and water conservation district the opportunity to focus its management responsibilities within a limited, but critical, geographical area, and thus maximize the use of what may be limited funds.

The management area is broadly outlined for each county soil and water conservation district. The estimated costs are based on an average of costs for a range of erosion control measures, and are intended to reflect the magnitude of broad budgeted costs within these areas. Site specific investigations will actually determine real costs.

Table 28
PRIORITY WATERSHEDS: ACREAGE AND COSTS
BY COUNTY S&WCD JURISDICTION

FRANKLIN COUNTY SOIL AND WATER CONSERVATION DISTRICT

Watershed Area	Critical Areas	Total Costs
Rend Lake		
Gun Creek	6,221 acres	$ 435,843
Marcum Branch	1,357 acres	95,071
Sandusky Creek	6,203 acres	434,582
Jackie Branch	204 acres	14,292
Rend Lake Total	13,985 acres	$ 979,788
West Frankfort Lakes	3,995 acres	279,890
County Total	17,980 acres	$1,259,678

Table 28 (Continued)

GALLATIN COUNTY SOIL AND WATER CONSERVATION DISTRICT

Bank/Channel Stabilization		Total Costs
Crawford Creek	5 miles	$ 38,016
Cane Creek	9 miles	68,428
North Fork Saline	4 miles	30,412
Watershed Area	**Critical Areas**	
Cane Creek	3354 acres	$234,981
County Total		$371,837

HAMILTON COUNTY SOIL AND WATER CONSERVATION DISTRICT

Bank/Channel Stabilization		
North Fork Saline	12 miles	$ 91,238
Watershed Area	**Critical Areas**	
North Fork Saline	8,678 acres	607,980
Rector Creek	2,400 acres	168,144
County Total		$867,362

JACKSON COUNTY SOIL AND WATER CONSERVATION DISTRICT

Watershed Area	Critical Areas	
Cedar Lake	7,615 acres	$ 533,507
Kinkaid Lake	29,602 acres	2,073,916
County Total	37,217 acres	$2,607,423

JEFFERSON COUNTY SOIL AND WATER CONSERVATION DISTRICT

Watershed Area	Critical Areas	
Rend Lake Atchison Creek	4,574 acres	$ 320,455

Table 28 (Continued)

Watershed Area	Critical Areas	Total Costs
Casey Fork	22,912 acres	$1,605,215
Mt. Vernon Reservoir	1,536 acres	107,612
Rayse Creek	27,790 acres	1,946,967
Gun Creek	4,570 acres	320,174
Big Muddy	21,555 acres	1,510,143
County Total	82,937 acres	$5,810,566

PERRY COUNTY SOIL AND WATER CONSERVATION DISTRICT

Watershed Area	Critical Areas	
Pinckneyville Reservoir	2,714 acres	$190,142
DuQuoin Reservoir	1,843 acres	129,136
County Total	4,557 acres	$319,278

POPE-HARDIN COUNTY SOIL AND WATER CONSERVATION DISTRICT

Watershed Area	Critical Areas	
Lusk Creek	3,280 acres	$229,797
Big Grande Pierre Creek	2,270 acres	159,036
County Total	5,550 acres	$388,833

SALINE COUNTY SOIL AND WATER CONSERVATION DISTRICT

Bank/Channel Stabilization		
Saline North Fork	4 miles	$ 30,413
Rector Creek	6 miles	45,620

Watershed Area	Critical Areas	
Harrisburg Reservoir	5120 acres	358,707
Eldorado Reservoir	1792 acres	125,547
County Total		$560,287

Table 28 (Continued)

WILLIAMSON COUNTY SOIL AND WATER CONSERVATION DISTRICT

Watershed Area	Critical Areas	Total Costs
Marion Reservoir	256 acres	$ 17,935
Crab Orchard Lake	32,973 acres	2,310,088
County Total	33,229 acres	$2,328,023

Source: GERP&DC Staff.

The watersheds outlined above represent the priority water quality areas impacted by erosion. Table 29 reflects the areawide priorities and costs. As such, it is estimated that best management practices will cost approximately $14,513,288 within the 208 area. The long range total cost to address all erosion problems regardless of their proximity to, or impact on, water quality is estimated at $82.9 million for approximately 1,182,000 acres of inadequately treated land. More importantly, 63.6% of this acreage is estimated to be cropland.

The second phase of the program is tentatively scheduled to be initiated after the fifth year of the program. This is highly dependent on: (1) the source and amount of funds made available for implementation of the first phase; and (2) the magnitude of the individual county management programs.

Funding

The Clean Streams Act of 1977 (P.L. 95-217) authorizes in Section 35 (Amending Sec. 208 of P.L. 92-500) $200 million for Fiscal Year 1979, and $400 million for Fiscal Year 1980 for purposes of installing and maintaining best management practices to control nonpoint source pollution. Cost share rates are not to exceed 50% of the total cost for measures, except that the Secretary of Agriculture may increase the cost where (1) the main benefits to be derived are related to improving offsite water quality; and (2) the matching share requirement may place a burden on the landowner which prevents him from participating in the program.

In view of the high water quality priority areas, it is recommended that the Secretary establish a federal cost share ratio of 80% for those

Table 29

AREAS OF CRITICAL EROSION IMPACTING WATER QUALITY, BY PRIORITY RANKING

	Total Watershed (Acres)	Critical Erosion	Control Measures Cost ($)
Priority 1			
Rend Lake	294,248	95,386 acres	$ 6,683,742
Cedar Lake	20,582	7,615 acres	533,507
Kinkaid Lake	59,854	29,602 acres	2,073,916
Marion Reservoir	6,323	256 acres	17,935
Harrisburg Reservoir	5,120	5,120 acres	358,707
Eldorado Reservoir	1,792	1,792 acres	125,547
Pinckneyville Reservoir	5,088	2,714 acres	190,142
TOTAL	393,007	142,485 acres	$ 9,982,496
Priority 2			
Crab Orchard Lake	81,228	32,973 acres	$ 2,310,088
West Frankfort Lakes	7,142	3,995 acres	279,890
Mt. Vernon Reservoir	5,888	1,536 acres	107,612
DuQuoin Reservoir	6,390	1,843 acres	129,136
TOTAL	100,648	40,347 acres	$ 2,826,726
Priority 3			
Lusk Creek	54,848	3,280 acres	$ 229,797
Big Grand Pierre	24,256	2,270 acres	159,036
North Fork Saline	284,616	8,678 acres	607,980
North Fork Saline (in miles)	---	20 miles	152,064
TOTAL			$ 1,148,877
Priority 4			
Rector Creek	7,616	2,400 acres	$ 168,144
Rector Creek (in miles)	---	6 miles	45,620
Cane Creek	88,550	3,354 acres	234,981
Cane Creek (in miles)	---	9 miles	68,428
Crawford Creek (in miles)	---	5 miles	38,016
TOTAL			$ 555,189
TOTALS			
Acres		202,814 acres	$14,209,160
Stream Stabilization Miles		40 miles	304,128
			$14,513,288

Source: GERP&DC Staff

practices to be installed within the water supply watersheds, and, should there be a financial burden on the landowner, increase the level to 90% only in those watersheds.

It is further recommended that the county ASCS meet with the soil and water conservation district in order to allocate, at a minimum, 50% of its annual budget to traditional cost share programs within the priority areas.

In addition, those funds allocated to the Shawnee Resource Conservation and Development Project be reviewed jointly with the member soil and water conservation districts for purposes of supporting specific erosion control measures within the priority areas, and especially those which may benefit publicly owned lands including right-of-ways and easements.

Staffing Needs

In addition to costs outlined above, there will occur an associated staffing cost to several of the management agencies. The Jefferson, Jackson, and Franklin County Soil and Water Conservation Districts will each require at least two additional soil conservation technicians. One additional soil conservation technician each will be required by the Gallatin and Pope-Hardin districts, and two each for Williamson, Saline, and Hamilton County Soil and Water Conservation Districts. Staffing costs (including benefits) are conservatively estimated at $18,000 per position.

Each of the proposed management agencies will need to evaluate and revise their agreement with the Soil Conservation Service in order to 1) arrange for the additional manpower; 2) reallocate the services of the District Conservationist with a proportionate work load concentration directed toward the priority areas; and 3) maximize the services available from the Area Office.

In view of the time constraints imposed by the normal budgeting and staffing process in use by the federal, state, and local agencies, alternative methods for minimal staffing, at least in the first year, may be pursued. It is recommended that each of the proposed management agencies request employees from their manpower program agents through the Comprehensive Employment Training Act (CETA) program. The

intent is to acquire staff which may be trained to perform several program-related functions in assisting the District Conservationist and the management agency.

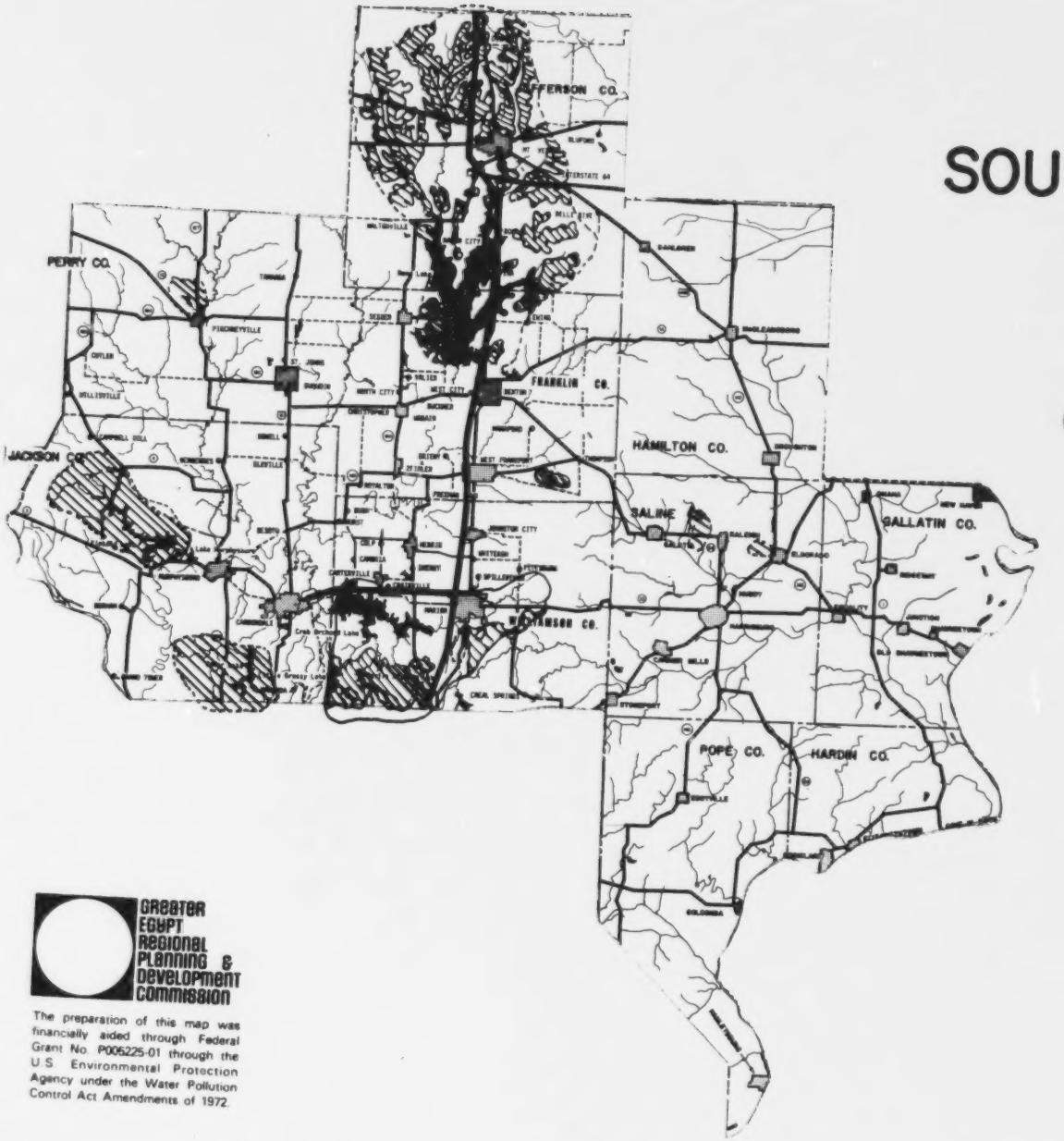
Regardless of the staffing procedure and levels of supporting funds, acceptance of designation as a management agency constitutes a commitment by that agency to implement the program. However, the rate of the orderly process through which erosion control measures may be implemented, and ultimately result in improved water quality, will be highly dependent upon adequate funding support and technical assistance from a combination of federal, state, and local sources.

The following map displays the general distribution of soils subject to excessive erosion within the 208 area. More importantly, the identification of the major reservoir watersheds brings into focus those areas where erosion control management systems are of the utmost concern. It is in these areas where the designated management agencies must concentrate their resources.

FIGURE 2

SOUTHERN ILLINOIS 208 AREA

RESERVOIR WATERSHEDS CONTAINING CRITICAL EROSION AREAS



NORTH

scale in miles

LEGEND

WATER SUPPLY WATERSHED

CONTACT (RECREATION) WATERSHED

CRITICAL EROSION AREAS

GREATER EGYPT REGIONAL PLANNING & DEVELOPMENT COMMISSION

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FOOTNOTES FOR CHAPTER 6

[1]Based on a review of IEPA's 1974 Water Quality Network Summary of Data, and 1976 Water Quality Printout data.

[2]Illinois State Water Survey: Water Quality Investigations of Rend Lake and Cedar Lake, 1978.

[3]Narrayaw, A. S., et. al., Economic Analysis of Erosion and Sedimentation, Crab Orchard Watershed, AERR 128, Department of Agricultural Economics, University of Illinois, Urbana, Illinois, 1974.

[4]U.S.E.P.A. Program Guidance Memorandum: SAM-30 (Federal Register, Vol. 42, No. 172, September 6, 1977, p. 44776).